United States
Department of
Agriculture

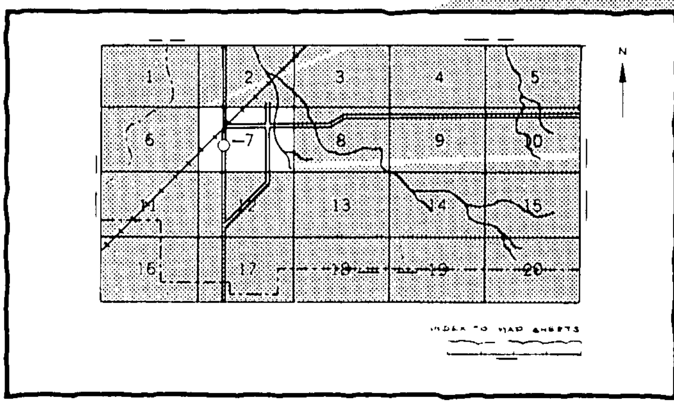
Soil
Conservation
Service

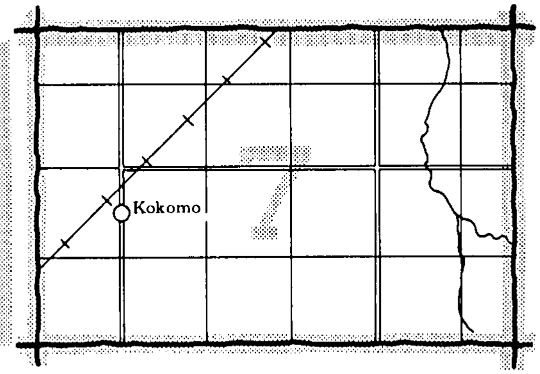
In cooperation with
University of Nebraska,
Conservation and
Survey Division

Soil Survey of Hamilton County, Nebraska

HOW TO USE

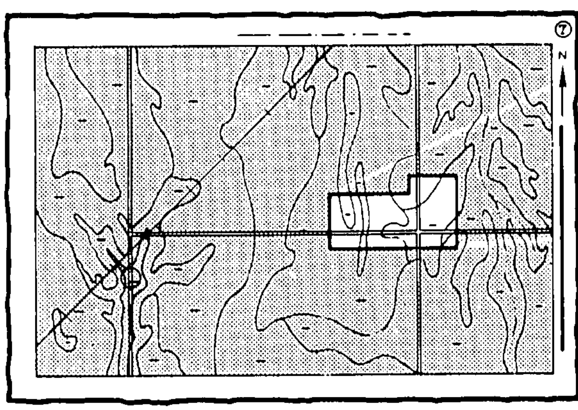
1. Locate your area of interest on the "Index to Map Sheets"

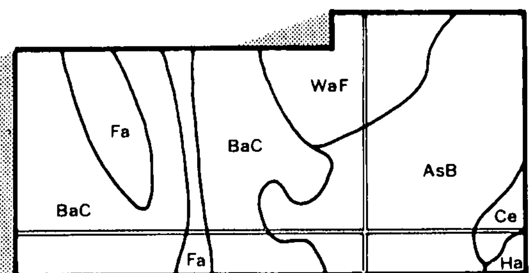




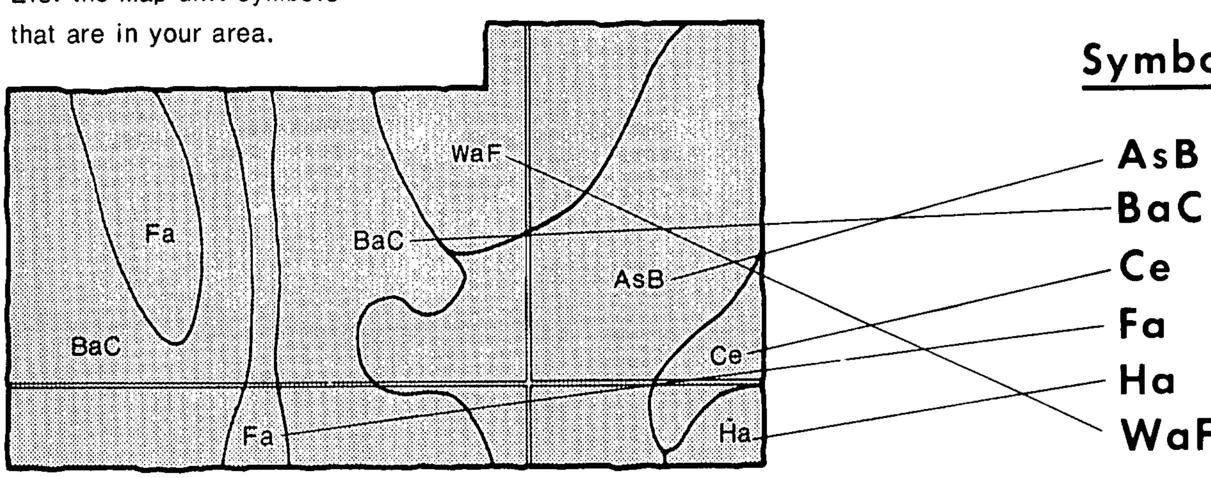
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



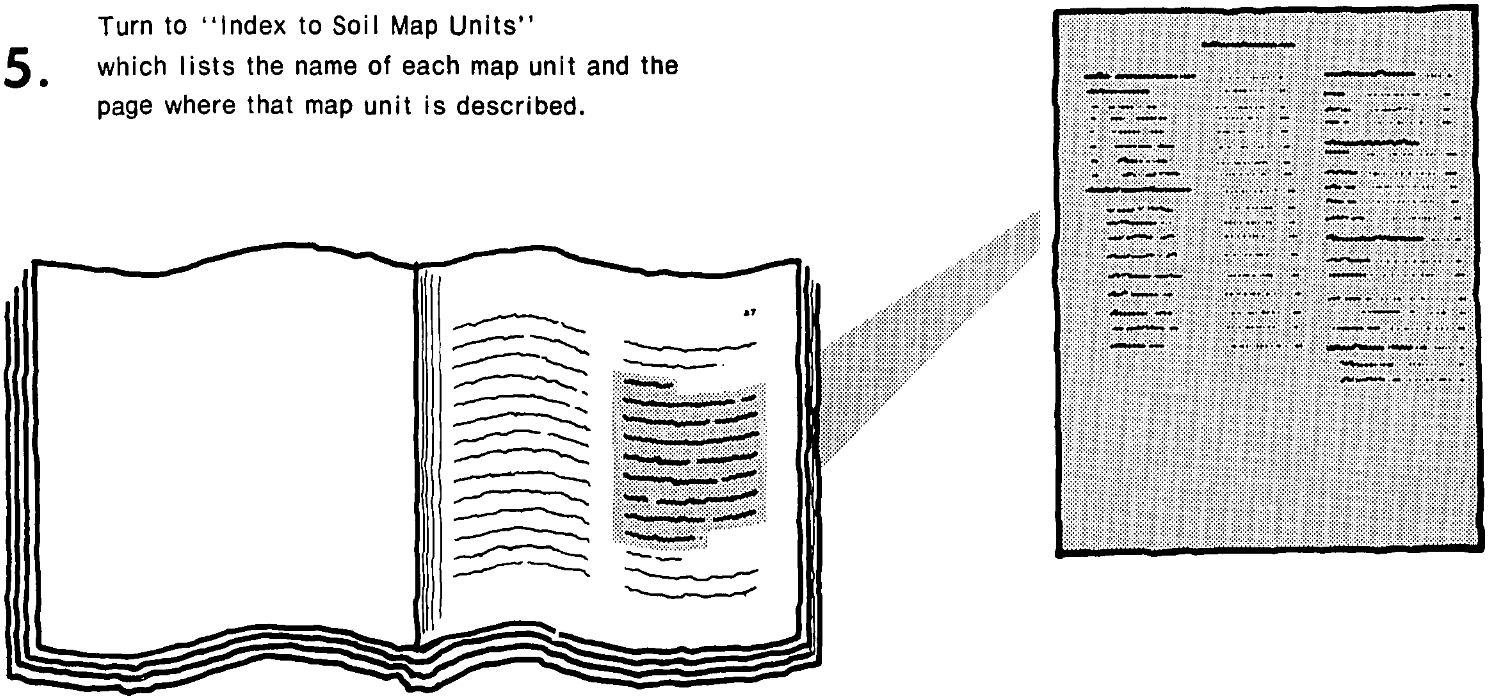


4. List the map unit symbols that are in your area.

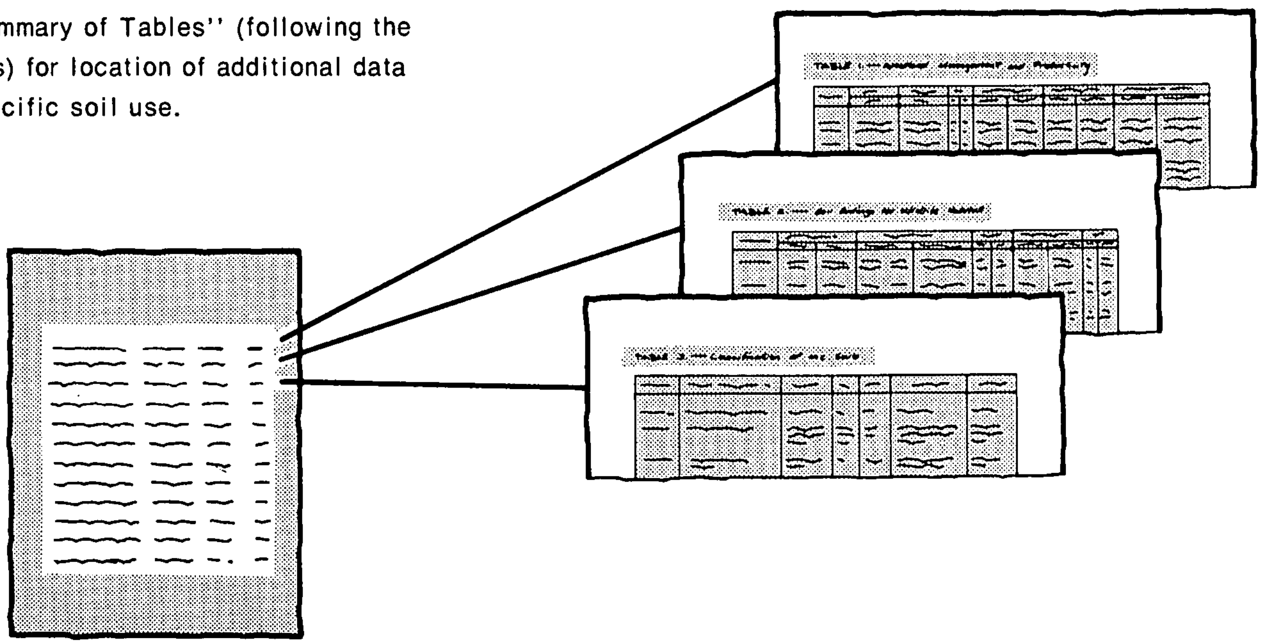


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1977-81. Soil names and descriptions were approved in 1981. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981. This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska, Conservation and Survey Division. It is part of the technical assistance furnished to the Upper Big Blue and Central Platte Natural Resource Districts. The Upper Big Blue and Central Platte Natural Resource Districts and the Hamilton County Commissioners provided financial assistance toward the purchase of aerial photography and assistance in field mapping.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Irrigation water management, farmstead windbreaks, terraces, contour farming, and grassed waterways improve productivity and reduce erosion in Hamilton County. Area is in the Hastings-Crete-Holder association.

Contents

Soil Series

Issued March 1985

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Hamilton County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Sherman L. Lewis
State Conservationist
Soil Conservation Service

Soil Survey of
Hamilton County, Nebraska

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Conservation and Survey Division

United States Department of Agriculture, Soil Conservation Service,
in cooperation with the University of Nebraska,
Conservation and Survey Division

HAMILTON COUNTY is in south-central Nebraska (fig. 1) in the Central Loess Plains. The county has an area of 546.5 square miles, or 349,760 acres.

Hamilton County was organized in 1870. Orville City, on the West Fork of the Big Blue River, was surveyed and recorded in 1870 and selected as the county seat the next year. The county seat was later moved to Aurora, in the center of the county. The population of Hamilton County grew from 18 pioneers in 1870 to about 15,000 people in 1890 *(3)*. In 1980 the population was 9,301.

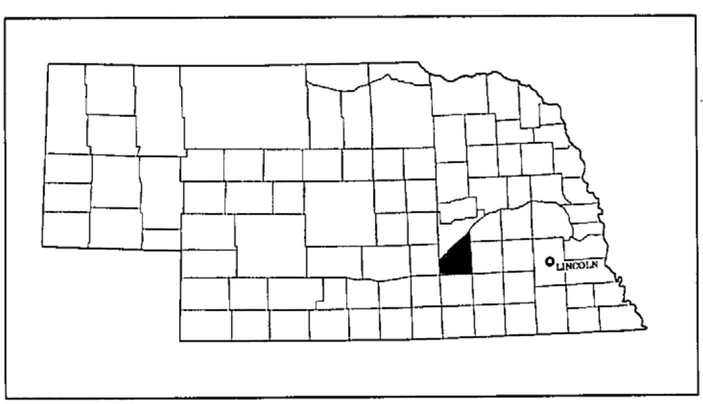

Figure 1.—Location of Hamilton County in Nebraska.

Farming has always been the major occupation in Hamilton County. Irrigated corn is grown extensively. Grain sorghum, soybeans, alfalfa, and small grains make up a small acreage. These crops provide feed for cattle, hogs, and sheep as well as cash income.

Cattle and hogs are sold to processors or to farmers who feed the livestock to market weight. Cattle and hogs are also marketed in adjacent counties or at larger markets, such as Omaha. Grain and feed products not used or stored on farms are sold to local grain elevators for transport to large markets. Dairy and poultry products produced on the farm are marketed locally or outside the county.

Farm-related industries and other industries also provide income in Hamilton County.

Hamilton County has good transportation facilities. Rail transport is provided by two railroads. Excellent highways serve the county, and hard-surface or gravel roads are on almost all section lines. The railroads and highways provide good, fast means of transporting grain and livestock to main markets. Nearly all towns in the county have modern elementary schools, and there are several high schools.

Most soils in Hamilton County are silty. A few areas adjacent to the Platte River are sandy and loamy. Slope ranges from nearly level to very steep. The soils range from excessively drained to very poorly drained.

The first soil survey of Hamilton County was made in 1927 *(6)*. The present survey updates the older one and provides additional information and larger maps that show the soils in greater detail.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

In Hamilton County, winters are cold because of frequent incursions of cold, continental air. Summers are hot with occasional interruptions of cooler air from the north. Snowfall is fairly frequent in winter, but snow cover is usually not continuous. Rainfall is heaviest in late spring and early summer. Annual precipitation is normally adequate for wheat, sorghum, and range grasses.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Aurora in the period 1963 to 1979. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 26 degrees F, and the average daily minimum temperature is 15 degrees. The lowest temperature on record, which occurred at Aurora on January 12, 1974, is -21 degrees. In summer the average temperature is 75 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred on August 2, 1964, is 107 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 26 inches. Of this, 19 inches, or about 70 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 15 inches. The heaviest 1-day rainfall during the period of record was 4.37 inches at Aurora on July 24, 1968. Thunderstorms occur on about 50 days each year, and most occur in summer.

The average seasonal snowfall is 31 inches. The greatest snow depth at any one time during the period of record was 20 inches. On an average of 20 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 14 miles per hour, in spring.

Strong, dry winds blowing over unprotected soils in spring cause occasional severe duststorms. There are occasional tornadoes and severe thunderstorms, some with hail. These storms are local and of short duration, and the pattern of damage is variable and spotty.

Geology

Quaternary age sand, silt, clay, and gravel mantled with loess overlie Tertiary and Cretaceous age rocks in Hamilton County *(4, 5)*.

The Ogallala Formation (Tertiary) is the youngest bedrock in Hamilton County and underlies the western edge of the county at a depth of 160 to 220 feet. Throughout the rest of the county the Niobrara and Carlisle Formations (Cretaceous) are the uppermost bedrock at a depth of 150 feet to more than 400 feet.

The older Quaternary sediments contain much sand and gravel, and they are the principal aquifer tapped by the irrigation and municipal wells. The Quaternary sediments at or near the surface are loess and eolian sand on the uplands and clayey to gravelly alluvium in the valleys. Loveland Loess mantled the entire county and is exposed on valley sides. This loess is brown with a pinkish to reddish tint and is moderately fine textured. Above the Loveland deposit is Peorian Loess. It mantles the uplands throughout the county and is the principal soil parent material. It is pale brown, slightly clayey, and weakly calcareous.

The most recent sediments are Bignell Loess, eolian sand, and alluvium in the valleys. Bignell Loess is several feet thick on stream terraces and on the uplands bordering the Platte River valley, but it thins rapidly to a foot or less in thickness in southeastern Hamilton County. It is similar to Peorian Loess in color. The eolian sand is closely associated in age and occurrence with Bignell Loess. The alluvium in the valleys is the most recently deposited soil parent material in the county. Two to four feet of alluvium has been deposited in most valleys since the native sod was plowed, and there is annual flooding on most valley areas except along the Platte River.

Ground Water

Ground water is held within the earth but is available through wells, springs, or recharge to streams. In Hamilton County, large supplies of ground water are available to wells from the Quaternary deposits. The possibility of deriving water from wells in the older rocks is limited and untested.

Yields from wells are adequate for domestic and livestock needs throughout the county. Wells yielding adequate quantities for municipal and irrigation use can be developed throughout the county except in small areas north of Marquette and in the extreme southwestern and southeastern corners of the county. The depth to water ranges from 5 feet in the alluvium near the Platte River to 135 feet on the uplands northeast of Hordville. Depths of 80 to 100 feet are typical in most parts of the uplands.

The chemical quality is generally favorable for domestic, livestock, municipal, and irrigation uses. The

ground water is hard or very hard with calcium and magnesium. Calcium and magnesium contribute to scale formation in steam boilers and pipes and combine with soap to produce insoluble curd. In places, iron and manganese in the water may cause stains on laundry or on kitchen and bath fixtures.

The total content of dissolved solids is well below the upper limit suggested for irrigation and domestic uses. The nitrate level is generally low, and any ground water contamination problems are localized. Objectional levels of nitrates in domestic wells can usually be avoided by relocating the well to an unpolluted area at a greater depth. The occasional iron problem can be corrected by treatment.

The water from newly developed domestic wells should be checked for bacterial content, nitrate level, and dissolved solid content. Existing domestic wells should be checked every 2 to 5 years or if contamination is suspected.

Physiography, Relief, and Drainage

Hamilton County is on the Central Loess Plains, which is part of the Great Plains. In general, the county is a nearly level and very gently sloping plain. The elevation ranges from 1,660 feet above sea level in the eastern part of the county to 1,900 feet in the western part.

The most prominent relief is the breaks paralleling the Platte River. The average elevation from the river valley to the uplands is about 100 feet. After the Platte, the West Fork of the Big Blue River is the most deeply entrenched stream in the county. The floor of the river valley is about 50 to 60 feet below the surrounding uplands. The river valley averages less than 1 mile in width.

Between drainage systems where the relief is more undulating, a few depressions or basins modify the landscape. These depressions are less than 10 feet to 30 feet below the surrounding land surface. Water ponds in these undrained areas for brief to very long periods.

Hamilton County is drained by several streams that flow generally eastward and by the Platte River. The Platte flows northeasterly along the northern border of the county. The West Fork of the Big Blue River and its tributaries dissect the southern part of the county. A tributary of the West Fork is known as the North Branch of the West Fork of the Big Blue River.

Other major drainageways are Beaver Creek, Lincoln Creek, and Big Blue River and their tributaries. Beaver Creek originates in Hall County and flows through the south-central part of Hamilton County. Lincoln Creek also originates just inside Hall County and flows through the central part of Hamilton County. The Big Blue River originates in Hamilton County as a large basin and flows through the north-central part of the county. Because these streams are close to their places of origin, they are not deeply entrenched nor do they have wide bottom lands. Davis Creek, in northeastern Hamilton County, also originates in this county. It flows easterly into Polk County.

Trends in Farming

In Hamilton County, 309,055 acres, or about 89 percent, was cultivated cropland in 1978. About 81 percent (251,000 acres) of this was irrigated, and 19 percent (58,055 acres) was dryfarmed. In 1974 there were 925 farms, and in 1978, 864 farms.

The irrigated acreage in Hamilton County has been increasing. Dryfarmed cropland was converted to irrigation at a rate of 6,000 acres per year from 1976 to 1980. There has also been rapid conversion of rangeland to cropland since the introduction of center-pivot irrigation. These trends are continuing, but at a much slower pace than in the past. Hamilton County is irrigated by 2,692 wells. About 80,000 acres is irrigated by about 600 center-pivot systems, and 134,281 acres is irrigated by gravity systems.

Corn is by far the most extensive crop in Hamilton County—218,000 acres in 1981. During the past few years, however, the acreage of soybeans has been increasing.

The increase in irrigated corn and other crops has increased the use of commercial fertilizer. In 1980, 35,898 tons of commercial fertilizer was sold in Hamilton County.

The number of cattle on farms remained about the same (49,000) between 1978 and 1980. The number of hogs rose to 51,400 in 1980. The number of sheep has increased, but the number of poultry has decreased.

Because of the lowering of the ground water table, there is an emphasis on increasing efficiency in irrigation to conserve ground water. Also, reducing energy use and other production costs is essential to farmers in Hamilton County.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data.

The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each association on the general soil map is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Somewhat poorly drained and poorly drained, nearly level soils on bottom lands

These soils are somewhat poorly drained and poorly drained. The poorly drained soils have a mixed cover of annual grasses, weeds, shrubs, and cedar trees and have very limited use for grazing. These soils are used mainly for wildlife habitat. The principal limitation of the poorly drained soils is wetness from the water table and the hazard of flooding.

The somewhat poorly drained soils are generally used for crops. The principal limitations are wetness in wet seasons and the hazard of wind erosion in dry seasons. Maintaining fertility is also a concern in managing these soils.

1. Gothenburg-Platte-Alda Association

Nearly level, somewhat poorly drained and poorly drained, loamy soils that are very shallow to moderately deep over sand and gravel and that formed in recent alluvium

This association consists mainly of soils on nearly level, low, ridge-like areas intervening with shallow braided channels and areas of riverwash on bottom lands of the Platte River valley (fig. 2). The fluctuating high water table and occasional or frequent flooding influence plant growth.

This association occupies about 7,300 acres, or about 2 percent of the county. Gothenburg soils make up about 31 percent of this association, Platte soils make up 27 percent, and Alda soils make up about 17 percent. The remaining 25 percent is minor soils.

Gothenburg soils are very shallow to gravelly sand and are poorly drained. Typically, the surface layer is dark gray, very friable, calcareous sandy loam about 3 inches thick. The upper part of the underlying material is light gray fine sand, and the lower part is light gray, mottled gravelly sand to a depth of 60 inches or more.

Platte soils are shallow to coarse sand or gravelly sand and are somewhat poorly drained. Typically, the surface layer is dark gray, very friable, calcareous loam about 7 inches thick. The next layer is light gray, friable, calcareous fine sandy loam about 5 inches thick. The underlying material is very pale brown; the upper 4 inches is mottled fine sand, and the lower part is gravelly sand to a depth of 60 inches or more.

Alda soils are moderately deep to sand or gravelly coarse sand and are somewhat poorly drained. Typically, the surface layer is dark gray, very friable loam about 4 inches thick. The subsurface layer is dark gray, very friable loam about 7 inches thick. The next layer is brown, very friable, calcareous fine sandy loam about 3 inches thick. The upper part of the underlying material is pale brown, mottled fine sandy loam about 8 inches thick; the middle part is very pale brown, mottled loamy sand and sand about 16 inches thick; and the lower part is very pale brown, mottled gravelly coarse sand to a depth of 60 inches or more. Carbonates are below a depth of 4 inches.

Minor in this association are Fonner variant, Inavale, and Cozad wet substratum soils and Pits and Dumps. Cozad wet substratum soils are in slightly higher positions than the major soils, and Fonner variant soils are in positions similar to those of the major soils. Inavale soils are in the low ridge-like areas. Pits and Dumps are on the bottom lands where sand and gravel have been mined.

Farming on the soils in this association is mainly forage production for livestock. Some areas of the minor soils and Platte soils are cultivated, and these areas are generally irrigated. Gothenburg soils support a mixed vegetation of largely annual grasses, sedges, weeds, shrubs, and cedar. These soils have very limited use for grazing. The native grassland is used for hay and grazing, principally of beef cattle. The rest of the areas

provide limited grazing and are used mainly for wildlife habitat.

Good range management, such as proper grazing and a planned grazing system, help to keep the native grasses in good condition.

Most farmsteads or headquarters are on land in other associations or on the minor soils that are more suitable for cultivation. The parts of farms in areas of this association range from 40 to 500 acres and average about 140 acres. Nearly all farms have access to good gravel or improved dirt roads along section lines. Some of the roads on section lines near the Platte River are trails and extend only to the south channel of the river.

Well drained, nearly level and very gently sloping soils on stream terraces

Nearly all areas of these soils are used for crops. Most are irrigated, generally by gravity or sprinkler systems. Wind erosion is the main hazard. Maintaining fertility is also a concern in management of these soils.

2. Ortello-Cozad Assocation

Deep, nearly level and very gently sloping, well drained, loamy and silty soils that formed in alluvium

This association consists mainly of soils on smooth stream terraces of the Platte River valley.

This association occupies about 3,940 acres, or about 1 percent of the county. Ortello soils make up about 53 percent of this association, and Cozad soils make up about 35 percent. The remaining 12 percent is minor soils.

Ortello soils are on stream terraces and foot slopes. Typically, the surface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 7 inches thick. The subsoil is pale brown, very friable fine sandy loam about 28 inches thick. The underlying material is very pale brown sandy loam to a depth of 60 inches or more.

Cozad soils are on stream terraces. Typically, the surface layer is grayish brown, very friable silt loam about 7 inches thick. The subsoil is light brownish gray, friable silt loam about 13 inches thick. The underlying material is calcareous silt loam; the upper part is pale brown, the middle part is very pale brown, and the lower part is light brownish gray to a depth of 60 inches.

Minor in this association are Hobbs channeled soils and Hord and Thurman soils. Hobbs channeled soils are

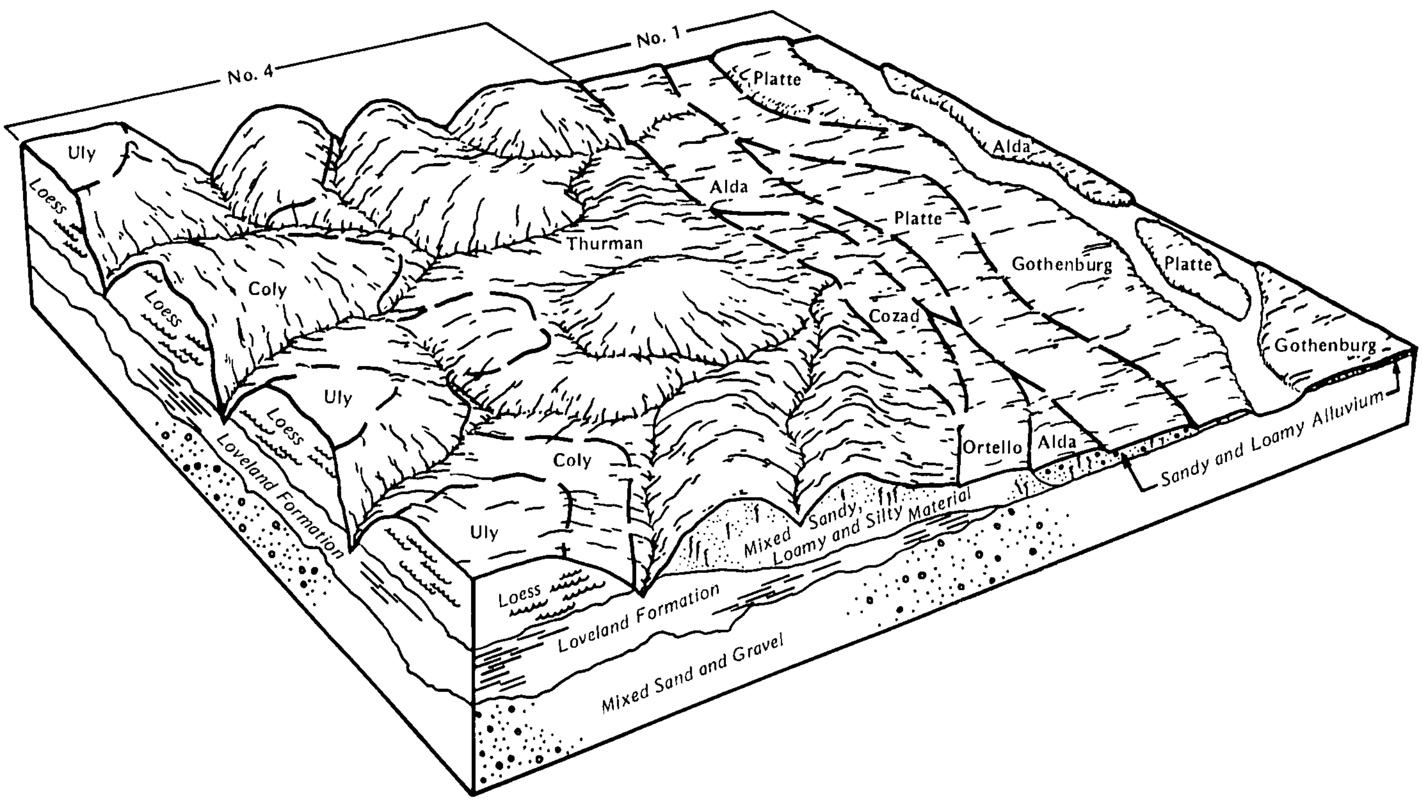

Figure 2.—Typical pattern of soils and relationship to topography and parent material in the Gothenburg-Platte-Alda association (1) and the Thurman-Coly association (4).

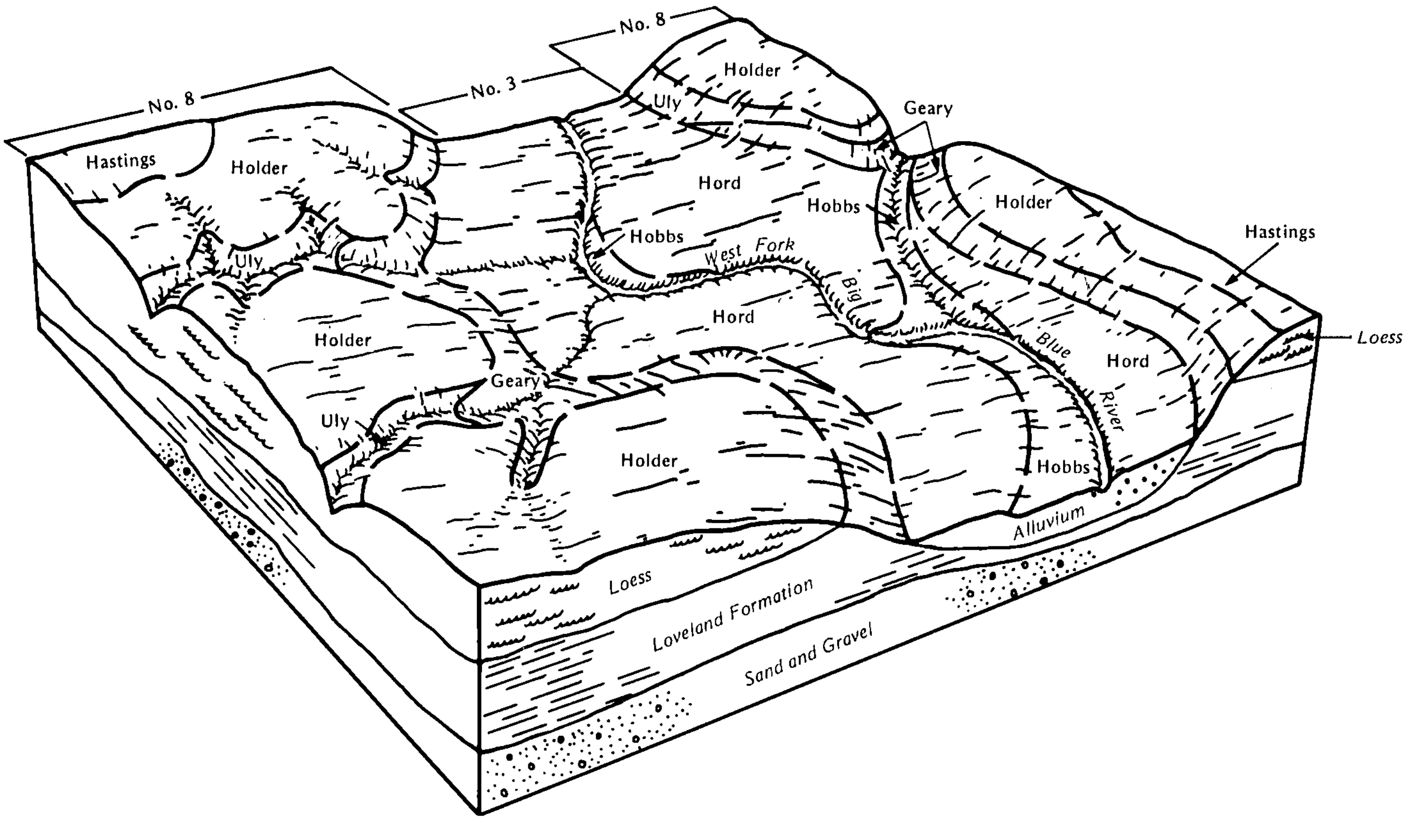

Figure 3.—Typical pattern of soils and relationship to topography and parent material in the Hord-Hobbs association (3) and the Holder-Geary association (8).

along the entrenched channels of intermittent drainageways. Hord soils are in positions similar to those of the Cozad soils. Thurman soils are on foot slopes and in higher positions than the major soils.

Farming on the soils in this association is diversified, mainly a combination of cash-grain and livestock enterprises. Nearly all of the areas are used for cultivated crops and are irrigated by gravity or sprinkler systems. Corn, grain sorghum, soybeans, and alfalfa are the principal irrigated crops. In some places land grading increases the efficiency of gravity irrigation. Wheat, grain sorghum, and alfalfa are the main dryfarmed crops.

Wind erosion is the main hazard. The principal concerns in management are controlling soil blowing, maintaining a high level of fertility, and conserving soil moisture.

Farms average about 320 acres. Nearly all farms have access to good gravel or hard-surface roads, nearly all of which run along section lines.

Well drained, nearly level to gently sloping soils on stream terraces and bottom lands

Nearly all areas of these soils are used for crops. Most are irrigated, generally by gravity or sprinkler systems. Water erosion and flooding are the main hazards. Maintaining fertility is also a concern in management of these soils.

3. Hord-Hobbs Association

Deep, nearly level to gently sloping, well drained, silty soils that formed in alluvium

This association consists mainly of soils on nearly level stream terraces and bottom lands (fig. 3).

This association occupies 22,000 acres, or about 6 percent of the county. Hord soils make up about 47 percent of this association, and Hobbs soils make up about 41 percent. The remaining 12 percent is minor soils.

Hord soils are on stream terraces. They are nearly level to gently sloping. Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick.

The subsurface layer is dark grayish brown, very friable silt loam about 9 inches thick. The very friable silt loam subsoil is about 28 inches thick. It is grayish brown in the upper part and light brownish gray in the lower part. The underlying material is light brownish gray silt loam to a depth of 60 inches or more.

Hobbs soils are on bottom lands. They are nearly level and are occasionally flooded. Typically, the surface layer is grayish brown, very friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 13 inches thick. The underlying material is silt loam. The upper part consists of thin, horizontally bedded strata of grayish brown and dark grayish brown, the middle part is light brownish gray, and the lower part is pale brown to a depth of 60 inches or more.

Minor in this association are Hobbs channeled soils on bottom lands along the entrenched channeled area of South Fork Big Blue River, Lincoln Creek, and Big Blue River. These areas are frequently flooded.

Farming on the soils in this association is diversified, mainly a combination of cash-grain and livestock enterprises. Nearly all of the areas are used for crops irrigated by gravity or sprinkler systems. Corn, grain sorghum, soybeans, and alfalfa are the principal irrigated crops. Winter wheat, grain sorghum, and alfalfa are the main dryfarmed crops. The channeled areas adjacent to the perennial streams are used for limited grazing and for wildlife habitat.

Occasional or rare flooding is the main hazard. The main concerns in management are maintaining a high level of fertility, conserving soil moisture, and reducing flooding along the streams. Water erosion is a hazard in a few areas where slope increases rapidly within a short distance.

Farms range from 80 to 640 acres average about 320 acres. Nearly all farms have access to good gravel or hard-surface roads. Some section lines do not have roads or trails.

Excessively drained to well drained, gently sloping to very steep soils on uplands

Most areas of these soils are in native or introduced grasses for grazing and hay. The main hazards are wind and water erosion. Maintaining good range condition is a concern in managing these soils.

4. Thurman-Coly Association

Deep, gently sloping to very steep, excessively drained to well drained, loamy and silty soils that formed in loamy and sandy materials or in loess

This association consists mainly of soils on strongly sloping and steep ridges and valley sides that are dissected by deeply entrenched drainageways having very steep sides (fig. 2, p. 8).

This association occupies about 8,430 acres, or about 3 percent of the county. Thurman soils make up about 51 percent of this association, and Coly soils make up 43 percent. The remaining 6 percent is minor soils.

Thurman soils are on tops and sides of smooth ridges on the foot slopes along the Platte River valley. They are gently sloping to steep and are somewhat excessively drained. Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 6 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 3 inches thick. The next layer is brown, very friable fine sandy loam about 7 inches thick. The underlying material is light yellowish brown, mottled loamy fine sand in the upper part and brownish yellow, mottled loamy fine sand in the lower part to a depth of 60 inches or more.

Coly soils are on side slopes of intermittent drainageways on the loess uplands. They are strongly sloping to very steep and are excessively drained to well drained. Typically, the surface layer is dark grayish brown, very friable silt loam about 5 inches thick. The next layer is pale brown, friable silt loam 4 inches thick. The underlying material is very pale brown, calcareous silt loam to a depth of 60 inches or more.

Minor in this association are Ortello soils. Ortello soils are well drained and are on foot slopes between the uplands and the stream terraces.

Farming on the soils in this association is diversified, mainly livestock enterprises with some cash-grain crops. About 80 percent of the acreage is native grassland and is used for hay and grazing, primarily by beef cattle. The native grassland consists of tall, mid, and short grasses. The remaining 20 percent usually has smoother slopes and is used for cultivated crops. Winter wheat, grain sorghum, and alfalfa are the main dryfarmed crops. Corn and grain sorghum are the principal irrigated crops. Nearly all irrigation is done by sprinkler systems.

Water erosion and soil blowing are the principle hazards in cultivated areas. In cultivated areas, erosion has removed the original dark surface layer and part of the underlying material. Maintaining good range condition is the primary concerning in range management. Proper grazing, timely deferment of grazing and haying, and a planned grazing system in which the order of grazing and rest are changed each year maintain or improve range condition.

Farms average about 480 acres. Most farm headquarters have access to good roads.

Well drained, nearly level to gently sloping soils on uplands

Nearly all areas of these soils are used for crops. Most areas are irrigated by either gravity or sprinkler systems. The principal hazards are soil blowing and water erosion. Maintaining fertility is also a concern in managing these soils.

5. Uly Association

Deep, nearly level to gently sloping, well drained, silty soils that formed in loess

This association consists mainly of soils in nearly level to gently sloping smooth areas or undulating low ridges and intervening swales of loess-mantled uplands. Natural drainageways are not always well defined.

This association occupies about 16,540 acres, or about 5 percent of the county. Uly soils make up about 81 percent of this association, and the remaining 19 percent is minor soils.

Uly soils typically have a surface layer of grayish brown, very friable silt loam about 7 inches thick. The subsoil is pale brown, very friable silty clay loam in the upper part and very pale brown, very friable, calcareous silt loam in the lower part. The subsoil is about 10 inches thick. The underlying material is very pale brown, calcareous silt loam to a depth of 60 inches or more.

Minor in this association are Ortello loamy substratum soils and Rusco soils. The Ortello soils are on low ridges in slightly higher positions than the Uly soils. Rusco soils are in lower positions than the Uly soils.

Farming on the soils in this association is diversified, mainly a combination of cash-grain and livestock enterprises. Nearly all of this association is irrigated by gravity or sprinkler systems. Corn, grain sorghum, soybeans, and alfalfa are the principal irrigated crops. Land grading is needed in most areas to increase efficiency of gravity irrigation systems. Winter wheat, alfalfa, and grain sorghum are the main dryfarmed crops.

Soil blowing is the principal hazard. The main concerns in management are maintaining a high level of fertility, conserving soil moisture, and controlling soil blowing.

Farms average about 400 acres. Nearly all farms have access to good gravel or hard-surface roads, which generally run along section lines.

6. Holder Association

Deep, nearly level to gently sloping, well drained, silty soils that formed in loess

This association consists mainly of soils on smooth side slopes on the loess-mantled uplands.

This association occupies 70,700 acres, or about 20 percent of the county. Holder soils make up about 86 percent of this association, and the remaining 14 percent is minor soils.

Holder soils typically have a surface layer of dark grayish brown, very friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, very friable silt loam about 5 inches thick. The upper part of the subsoil is grayish brown, friable silty clay loam about 8 inches thick; the middle part is brown silty clay loam about 5 inches thick; and the lower part is pale brown, friable silt loam about 6 inches thick. The underlying material is very pale brown silt loam to a depth of 60 inches or more. The lower part of the underlying material is calcareous.

Minor in this association are Ortello loamy substratum soils and Holder thick surface soils. The Ortello soils are nearly level to gently sloping and generally are above the Holder soils. Holder thick surface soils are nearly level and are at about the same elevation as the major soils.

Farming on the soils in this association is diversified, mainly a combination of cash-grain and livestock enterprises. Some farms are entirely cash-grain. Nearly all areas are used for cultivated crops irrigated by gravity or sprinkler systems. Some of the irrigation wells have a low pumping capacity. Corn, grain sorghum, and soybeans are the principal irrigated crops. Wheat and grain sorghum are the main dryfarmed crops.

The main concerns in management are maintaining a high level of fertility and conserving soil moisture. Water erosion is a hazard mainly on the gently sloping soils.

Farms average about 480 acres. Gravel or hard-surface roads run along most section lines.

Well drained and moderately well drained, nearly level to gently sloping soils on uplands

Nearly all areas of these soils are used for crops. Most areas are irrigated by either gravity or sprinkler systems. The principal hazards are wind and water erosion. Maintaining fertility is also a concern in managing these soils.

7. Hastings-Crete-Holder Association

Deep, nearly level to gently sloping, well drained and moderately well drained, silty soils that formed in loess

This association consists mainly of soils on smooth side slopes on the loess-mantled uplands (fig. 4).

This association occupies 183,310 acres, or about 52 percent of the county. Hastings soils make up about 67 percent of this association, Crete soils make up about 12 percent, and Holder soils make up about 11 percent. The remaining 10 percent is minor soils.

Hastings soils are nearly level and gently sloping and are well drained. Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 6 inches thick. The subsoil is about 16 inches thick. The upper part of the subsoil is dark grayish brown, friable silty clay loam; the middle part is brown, firm silty clay; and the lower part is yellowish brown, friable silty clay. The underlying material is pale brown silt loam to a depth of 60 inches or more. It is calcareous in the lower part.

Crete soils are nearly level and moderately well drained. Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is 19 inches thick. It is

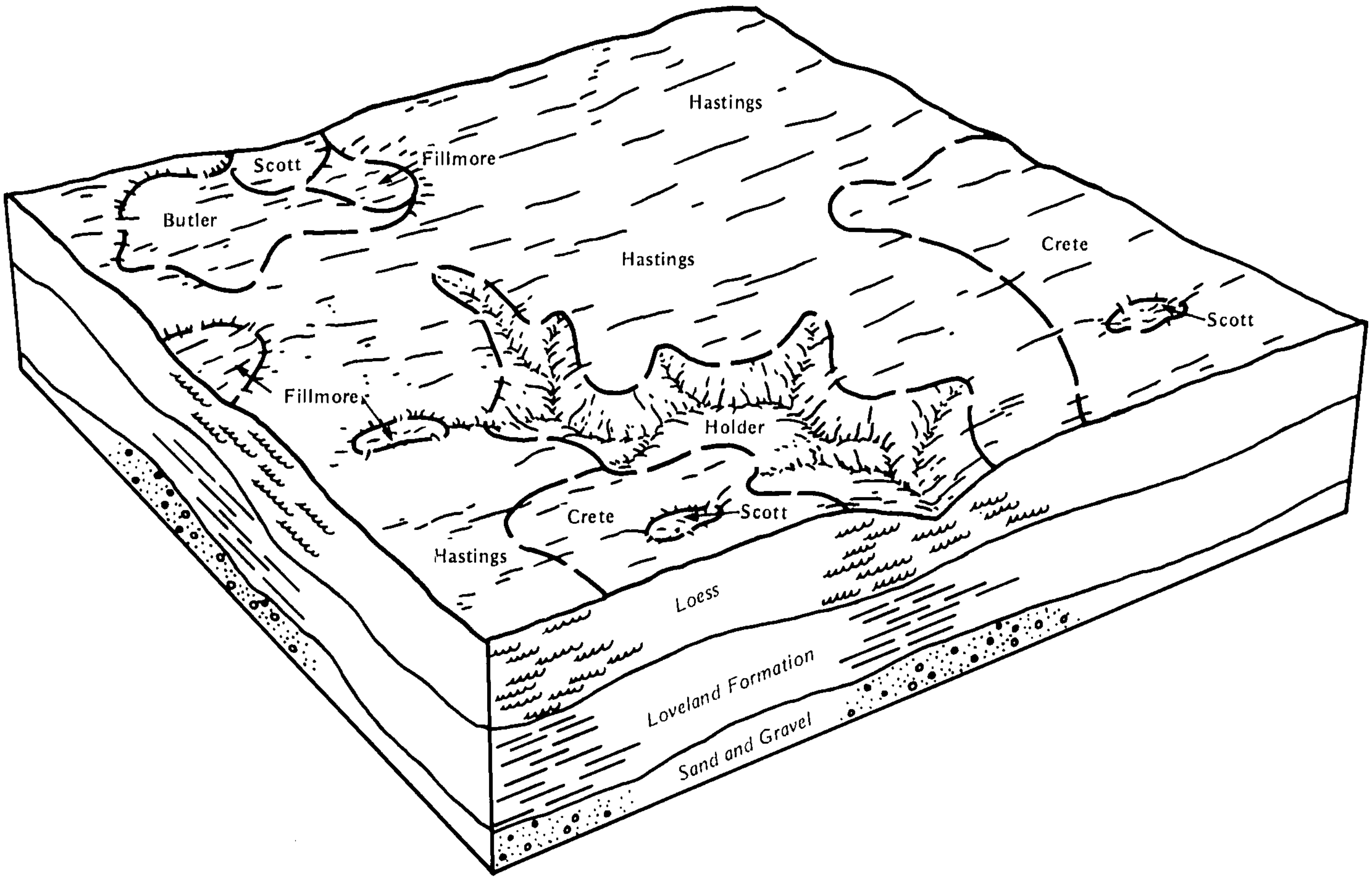

Figure 4.—Typical pattern of soils and relationship to topography and parent material in the Hastings-Crete-Holder association.

grayish brown, friable silty clay loam in the upper part; brown, firm silty clay in the middle part; and pale yellow, friable silty clay loam in the lower part. The underlying material is light gray, calcareous silt loam to a depth of 60 inches or more.

Holder soils are nearly level to gently sloping and are well drained. Typically, the surface layer is dark grayish brown, very friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, very friable silt loam about 5 inches thick. The upper part of the subsoil is grayish brown, friable silty clay loam about 8 inches thick; the middle part is brown, friable silty clay loam about 5 inches thick; and the lower part is pale brown, friable silt loam about 6 inches thick. The underlying material is very pale brown silt loam to a depth of 60 inches or more. The soil is calcareous below a depth of 50 inches.

Minor in this association are Butler, Fillmore, Scott, and Massie soils. These soils are all nearly level and are below the major soils.

Farming on the soils in this association is diversified, mainly a combination of cash-grain and livestock enterprises. However, some enterprises are only cash grain. Nearly all of the acreage of this association is used for cultivated crops irrigated by gravity or sprinkler systems. Corn, grain sorghum, soybeans, and alfalfa are the principal irrigated crops. A few areas of dryfarmed winter wheat and grain sorghum are grown.

The main concerns in management are maintaining a high level of fertility and conserving soil moisture. Water erosion is a hazard in a few areas where the soils are gently sloping.

Farms range from 80 to 960 acres and average about 480 acres. Nearly all farms have access to good gravel or hard-surface roads. Some section lines do not have roads or trails.

Well drained and somewhat excessively drained, gently sloping to steep soils on uplands

These soils are mostly well drained. Some areas are used for crops and some are in range or pasture. Some cultivated areas are irrigated, generally by sprinkler systems. The principal hazard is water erosion. Maintaining fertility or good range condition is a concern in managing these soils.

8. Holder-Geary Association

Deep, gently sloping to steep, well drained and somewhat excessively drained, silty soils that formed in loess

This association consists mainly of soils on gently sloping and strongly sloping ridges and valley sides. They are dissected by deeply entrenched drainageways that have moderately steep and steep side slopes (fig. 3, p. 9).

This association occupies about 29,140 acres, or about 9 percent of the county. Holder soils make up about 71 percent of this association, and Geary soils make up 13 percent. The remaining 16 percent is minor soils.

Holder soils are on smooth ridgetops and side slopes on loess-mantled uplands. They are gently sloping or strongly sloping, well drained, and eroded. Typically, the surface layer is pale brown, friable silty clay loam about 6 inches thick. The underlying material is light gray and very pale brown silt loam to a depth of 60 inches or more.

Geary soils are on the sides of intermittent drainageways on loess-mantled uplands. They are strongly sloping to steep and are well drained and somewhat excessively drained. Typically, the surface layer is brown, very friable silt loam about 7 inches thick. The subsoil is brown, friable silty clay loam in the upper part; light brown, friable silty clay loam in the middle part; and light brown, very friable silt loam in the lower part. The subsoil is about 29 inches thick. The underlying material is light gray, calcareous silt loam to a depth of 60 inches or more.

Minor in this associaton are Uly and Hobbs soils. Uly soils are moderately steep or steep and are on side slopes in the upper reaches of the intermittent drainageways. They are well drained and somewhat excessively drained. Hobbs soils are on the narrow bottom lands of intermittent drainageways and are occasionally flooded.

Farming on the soils in this association is diversified, mainly a combination of cash-grain and livestock enterprises. Most of the steeper soils are in native grasses that are grazed by beef cattle. Soils on the smoother side slopes are cultivated. The main dryfarmed crops are grain sorghum and winter wheat. Most irrigation is by sprinkler systems, and the irrigated crops are corn, grain sorghum, and alfalfa.

Water erosion is a serious hazard in the cultivated areas. Much of the original surface layer has been removed, and many small gullies form after heavy rains. Controlling erosion, conserving moisture, and maintaining soil fertility are the main concerns in management.

Range supports mid and short grasses.

Farms average about 400 acres. Nearly all farms have access to good gravel roads. Some section lines do not have roads or trails.

9. Hastings Association

Deep, gently sloping and strongly sloping, well drained silty soils that formed in loess

This association consists mainly of soils on ridges and side slopes of the loess-mantled uplands.

This association occupies about 8,400 acres, or about 2 percent of the county. Hastings soils make up about 53 percent of this association, and the remaining 47 percent is minor soils.

Hastings soils are eroded. Typically, the surface layer is brown, firm silty clay loam about 5 inches thick. The subsurface layer is brown, firm silty clay loam about 3 inches thick. The subsoil is light yellowish brown silty clay loam about 5 inches thick. The underlying material is very pale brown silt loam to a depth of 60 inches or more.

Minor in this association are Geary, Hobbs, and Uly soils. Geary soils are strongly sloping to steep and are well drained. They are on side slopes below the Hastings soils. Hobbs soils are on narrow bottom lands of intermittent drainageways and are occasionally flooded. Uly soils are moderately steep or steep and are well drained or somewhat excessively drained. They are on side slopes below the Hastings soils.

Farming on the soils in this association is diversified, mainly a combination of cash-grain and livestock enterprises. Much of the steeper soils are in native grasses grazed by cattle. The smoother slopes are used for cultivated crops. The main dryfarmed crops are grain sorghum and winter wheat. Most irrigation is done by sprinkler systems, and the irrigated crops are corn, grain sorghum, and alfalfa.

Water erosion is a serious hazard in cultivated areas. Much of the original surface layer has been removed, and many small gullies form after heavy rains if the soil is left unprotected. Controlling erosion, conserving moisture, and maintaining soil fertility are the main concerns in management.

Farms average about 400 acres. Nearly all farms have access to good gravel roads. Some section lines do not have roads or trails.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Holder silty clay loam, 3 to 6 percent slopes, eroded, is one of several phases in the Holder series.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits and Dumps is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Ag—Alda loam, 0 to 2 percent slopes. This nearly level soil is on bottom lands and is occasionally flooded. It is somewhat poorly drained and is moderately deep over sand or gravelly coarse sand. This soil formed in loamy sediment. The areas are irregular in shape and range from 10 to 120 acres in size.

Typically, the surface layer is dark gray, very friable loam about 4 inches thick. The subsurface layer is dark gray, very friable loam about 7 inches thick. The next layer is brown, very friable, calcareous fine sandy loam about 3 inches thick. The upper 8 inches of the underlying material is pale brown, mottled fine sandy loam; the next 16 inches is very pale brown, mottled loamy sand and sand; and the lower part is very pale brown, mottled gravelly coarse sand to a depth of 60 inches or more. Carbonates are below a depth of 4 inches. In places, depth to the gravelly sand is less than 20 inches because extensive land grading for gravity irrigation has removed the upper layers. In some small areas, carbonates have been leached to below a depth of 15 inches. In a few areas, the texture of the upper 24 inches is sandy loam, loam, or clay loam. In places, the depth to coarse sand and gravelly coarse sand is greater than 38 inches.

Included with this soil in mapping are small areas of Platte soils. Platte soils are shallower to the very coarse material than the Alda soil and are along the narrow, shallow drainageways that cross areas of this unit. Small areas of strongly alkaline soils are in some low areas. The included soils make up less than about 13 percent of this map unit.

Permeability is moderate in the upper part of the profile and very rapid in the coarse underlying material. Available water capacity is low, but moisture is released to plants readily. Runoff is slow. Organic matter content is moderate, and natural fertility is medium. Plant roots are generally restricted to the soil material above the gravelly coarse sand. the seasonal high water table is at a depth of about 2 feet in most wet years and about 3 feet in most dry years. The water intake rate is moderate.

Some of the acreage of this map unit is farmed. The rest is range. Much of the cultivated area is irrigated.

This soil is suited to dryfarmed corn, grain sorghum, wheat, and oats. Grasses and alfalfa can be grown for hay or pasture. The principal limitation is the wetness, and tillage is generally delayed in early spring. Conservation tillage, which leaves crop residue on the surface, helps to reduce wind erosion and maintain tilth. Perforated tile or V-ditches can be used to lower the water table where suitable outlets are available.

This soil is suited to irrigated corn, grain sorghum, alfalfa, soybeans, and pasture using either gravity or sprinkler systems. Land leveling generally is needed for gravity irrigation, but deep cuts should be avoided to prevent exposing the coarse textured underlying material. Tillage is generally delayed in spring. Because of the very rapid permeability of the coarse underlying material and the low available water capacity of this soil, applications of water and fertilizer must be light but frequent. Returning crop residue to the soil helps to maintain and improve the organic matter content and reduces wind erosion during periods of low rainfall.

This soil is suited to range. Overgrazing by livestock when the soil is wet causes surface compaction, poor tilth, and deterioration of the vegetation. Preventing overgrazing and alternately grazing and resting the pastures help to keep the grasses in good condition.

This soil is suited to trees and shrubs for windbreaks. Seedlings generally survive and grow well if competing vegetation is controlled or removed by good site preparation, timely cultivation between rows, and the careful use of appropriate herbicides or hand hoeing within the rows.

This soil is generally not suitable for septic tank absorption fields because of flooding and wetness and the poor filtering capacity of the soil. Other sites should be found. Sewage lagoons must be constructed on fill to raise the bottom of the lagoon above the seasonal high water table. Lagoons also need to be diked as protection from flooding, and they need to be lined or sealed to prevent seepage. The sides of shallow excavations can be temporarily shored to prevent sloughing or caving. Buildings can be constructed on raised, well compacted fill above the high water table.

Constructing roads on suitable, well compacted fill above flood level and providing adequate side ditches and culverts help to prevent flood damage and wetness.

This soil is in capability units IIIw-4 dryland and IIIw-7 irrigated, Subirrigated range site, and windbreak suitability group 2S.

Bu—Butler silt loam, 0 to 1 percent slopes. This nearly level claypan soil is mostly in flat or slightly concave areas on the uplands. Some areas are at slightly higher positions within and surrounding the bottoms of the larger basins or lagoons. Water is ponded briefly following heavy rains. This soil is deep and somewhat poorly drained. It formed in loess. The areas are commonly irregular or somewhat oblong in shape and range from 5 to 200 acres in size.

Typically, the surface layer is dark gray, friable silt loam about 6 inches thick. The subsurface layer is about 5 inches thick. It is dark gray, friable silt loam in the upper part and gray, friable silt loam in the lower part. The subsoil is about 27 inches thick. It is dark gray, very firm silty clay in the upper part and light gray, firm silty clay loam in the lower part. The underlying material is light gray silty clay loam to a depth of 60 inches or more. In places, the combined thickness of the surface and subsurface layers is less than 10 inches or more than 16 inches because of cuts and fills made during land leveling. Some areas are briefly ponded.

Included with this soil in mapping are small areas of Crete, Detroit, and Fillmore soils. Crete and Detroit soils are in slightly higher positions and are better drained than the Butler soil. Fillmore soils are in small depressions and are more poorly drained unless they have been filled during land leveling. The included soils make up about 3 to 10 percent of this map unit.

Permeability is slow, and available water capacity is high. Runoff is slow. Organic matter content is moderate, and natural fertility is medium. Tilth is fair. The shrink-swell potential is moderate in the surface layer and high in the subsoil. The perched seasonal high water table is at a depth of about 0.5 to 2 feet, mainly during March through July. The water intake rate is low.

Most of the acreage of this soil is cultivated. Some small areas are in native grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, and wheat. The principal limitation is wetness in spring. The excessive water delays tillage and can retard crop growth, but crop failure is infrequent. The soil puddles if tilled when too wet. Upon drying, the surface becomes hard and difficult to work. Conservation tillage, which leaves crop residue on the surface, reduces compaction, conserves soil moisture, and protects the surface from wind erosion during dry seasons. Returning residue to the soil also improves tilth and water intake.

This soil is suited to irrigated corn, grain sorghum, alfalfa, and soybeans. Either gravity or sprinkler systems are suitable. Land leveling, a tailwater recovery system, and surface drainage are generally needed. Conservation tillage, which leaves residue on the surface, helps to prevent wind erosion and excessive loss of moisture. Irrigation water should be applied to meet the needs of the crops, but it should be applied at a rate that permits the soil to absorb as much of the water as possible with the best runoff.

This soil is suited to range. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Preventing overgrazing and defering grazing or haying help to maintain or improve the range condition.

This soil provides fair sites for windbreaks. Trees and shrubs that tolerate wetness and a high water table should be used. Seedlings generally survive and grow if competing vegetation is controlled or removed by good site preparation, timely cultivation between the rows, and careful use of selected herbicides or rototilling within the rows.

This soil is generally not suitable for septic tank absorption fields because of the wetness and slow permeability. Other sites should be found. Sewage lagoons must be constructed on fill to raise the bottom of the lagoon above the perched seasonal high water table and the brief ponding. Dwellings and buildings also should be constructed on raised, well compacted fill above the perched high water table. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

Constructing roads on suitable, well compacted fill and providing adequate side ditches and culverts help to prevent damage by ponding and wetness. Damage to roads and streets by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. The base material for roads can be mixed with additives, such as hydrated lime, to reduce shrinking and swelling.

This soil in capability units IIw-2 dryland and IIw-2 irrigated, Clayey range site, and windbreak suitability group 2W.

CoD2—Coly silt loam, 6 to 11 percent slopes, eroded. This strongly sloping soil is on uplands. It is deep and well drained. This soil formed in loess. The areas range from 5 to 70 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 5 inches thick. The underlying material is calcareous silt loam to a depth of 60 inches or more. The upper part of the underlying material is pale brown, and the lower part is very pale brown. Over most of the area, the original darkened surface soil has been removed by erosion. Rills and small gullies are common after heavy rains but are generally filled in by tillage. In places, the soil is calcareous at the surface.

Included with this soil in mapping are small areas of eroded Holder soils. In Holder soils, the surface layer is thicker than in the Coly soil, the subsoil is more clayey, and carbonates have been leached to greater depths. The included soils make up less than 10 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is rapid. Organic matter content is low, and natural fertility is low. Tilth is generally good. The water intake rate is moderate.

Most of the acreage of this soil is farmed. The rest is isolated areas that have been seeded to introduced grasses and are used for grazing.

This soil is poorly suited to dryfarmed corn, grain sorghum, and small grains. Grasses and alfalfa can be grown for hay and pasture. The hazard of water erosion is the main problem. In hot, dry summers, crops can be damaged by lack of moisture. Runoff and water erosion can be controlled by terraces, grassed waterways, and contour farming. Conservation tillage, which leaves crop residue on the surface as in stubble mulching of small grain or no-till planting of row crops, is effective in controlling erosion and runoff. Row crops should be limited and close-growing crops used in the rotation. Gullies can be shaped and seeded to grass. Grassed field borders help to control runoff and can be used as turn rows, roadways, and wildlife habitat.

Alfalfa and introduced grasses are suitable for irrigated farming. Row crops are not suitable because management of the water is difficult and erosion is a severe hazard. Sprinkler irrigation is the only method suited to this soil. Erosion by the combination of rainfall and irrigation water is difficult to control. Terraces and grassed waterways help to control water erosion. Conservation tillage, which leaves crop residue on the surface as in stubble mulching of small grains and no-till planting of row crops, is effective in controlling erosion. The rate at which water can be applied is limited by the moderate intake rate of the soil.

The use of this soil for range controls wind and water erosion effectively. Overgrazing by livestock, haying at the wrong time, and cutting the grasses too short reduce the protective cover and cause the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded areas.

This soil is suited to trees and shrubs for windbreaks. Survival of adapted species is good and growth is fair if competing vegetation is controlled by rototilling or careful use of an appropriate herbicide within the rows or by cultivation between the rows. Contour planting and terraces reduce water loss and erosion. Species that tolerate excess amounts of calcium in the soil should be selected.

This soil is generally suitable for septic tank absorption fields, but the land should be reshaped and the filter lines installed on the contour for proper operation. Sites for sewage lagoons must be graded to modify the slope and shape the lagoon. Sewage lagoons need to be lined or sealed to prevent seepage. Dwellings and small commercial buildings can be designed to fit the slope, or the soil can be graded to an acceptable slope.

Cuts and fills are generally needed to provide a suitable grade for roads and streets. The surface pavement and subbase should be thick enough to compensate for the low strength of the soil material.

Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate ditches help to provide the needed surface drainage.

This soil is in capability units IVe-9 dryland and IVe-6 irrigated, Limy Upland range site, and windbreak suitability group 8.

CoF—Coly silt loam, 11 to 30 percent slopes. This steep soil is on side slopes of uplands. It is deep and somewhat excessively drained. This soil formed in calcareous loess. The areas range from 5 to 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 5 inches thick. The next layer is pale brown, friable silt loam about 4 inches thick. The underlying material is very pale brown, calcareous silt loam to a depth of 60 inches.

Included with this soil in mapping are small areas of steep Geary and Thurman soils. Geary and Thurman soils are below the Coly soil. Geary soils have a darker, thicker surface layer, a more clayey subsoil, and redder hue in the subsoil. Thurman soils have more sand throughout the profile. The included soils make up 10 to 15 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is very rapid. Organic matter content is low, and natural fertility is low.

Nearly all of the acreage of this soil is used for range. The rest is isolated small areas that are cultivated.

This soil is not suited to farming, either dryland or irrigated, because it is too steep and erodible. A few small areas are cultivated and are severely eroded; these areas can be planted to native grasses for grazing. Dams for livestock water, erosion control structures, and flood retention reservoirs can be built in some of the drainageways.

The use of this soil for range controls erosion effectively. Overgrazing by livestock reduces the protective cover and causes the native vegetation to deteriorate. Deferment of grazing helps to maintain or improve the range condition. Undesirable woody plants can be controlled by chemical or mechanical means.

Most areas of this soil are too steep and erodible for windbreaks. In a few places, trees can be planted by hand, but they need special tending.

This soil generally is not suitable for sanitary facilities because of the steep slopes. Other sites should be found. Dwellings and small commercial buildings can be designed to fit the slope, or the soil can be graded to an acceptable slope.

Cuts and fills are generally needed to provide a suitable grade for roads and streets. The surface pavement and subbase should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability unit VIe-9 dryland, Limy Upland range site, and windbreak suitability group 10.

CoG—Coly silt loam, 30 to 60 percent slopes. This very steep soil is on uplands along dissected breaks to the Platte River valley. This soil is deep and excessively drained. It formed in loess. The areas range from 20 to 120 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 2 inches thick. The next layer is brown, very friable silt loam about 4 inches thick. The underlying material is very pale brown, calcareous silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Geary and Thurman soils, both of which are on lower parts of the deeply entrenched drainageways. Geary soils are steep. They have a darker, thicker surface layer than the Coly soil and a redder, more clayey subsoil. Thurman soils have more sand throughout the profile. The included soils make up 8 to 15 percent of this map unit.

Permeability is moderate, and available water capacity is high. Runoff is very rapid. Organic matter content and natural fertility are low.

All of the acreage of this soil is in mixed native grasses and redcedar. The trees cover 40 to 60 percent of the area.

This soil is not suited to farming, either dryland or irrigated, because it is too steep and erodible.

The use of this soil for range controls water erosion effectively. Overgrazing reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing helps to maintain or improve the range condition. Grazing is limited by the steepness and by competition from the cedar trees.

This soil is too steep and erodible for windbreaks. In a few places, trees can be planted by hand, but they need special tending.

This soil is not suitable for sanitary facilities or buildings because of the very steep slopes. Other sites should be found.

Extensive cuts and fills are generally needed to provide a suitable grade for roads. The surface pavement and subbase should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate

side ditches help to provide the needed surface drainage.

This soil is in capability unit VIIe-9 dryland, Thin Loess range site, and windbreak suitability group 10.

Cw—Cozad silt loam, 0 to 1 percent slopes. This nearly level soil is on stream terraces of the Platte River valley. This soil is rarely flooded. It is deep and well drained. This soil formed in alluvium. The areas range from 10 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 7 inches thick. The subsoil is light brownish gray, friable silt loam about 13 inches thick. The underlying material is calcareous silt loam to a depth of about 60 inches. The upper part of the underlying material is pale brown, the middle part is very pale brown, and the lower part is light brownish gray. In some areas, thin strata of clay loam are in the underlying material. In a few small areas, the surface layer is silty clay loam, loam, or fine sandy loam. In places, the surface layer is 10 to 24 inches thick. In places, the surface layer has been altered by land leveling.

Included with this soil in mapping are small areas of loamy Ortello soils in slightly higher positions than the Cozad soil and along intermittent drainageways. In some areas along intermittent drainageways are soils that have a perched seasonal high water table at a depth of about 4 to 6 feet. The included soils make up 5 to 15 percent of this map unit.

Permeability is moderate, and available water capacity is high. Runoff is slow. Organic matter content is moderately low, and natural fertility is medium. Tilth is good, and this soil can be easily tilled within a fairly wide range of moisture content. The water intake rate is moderate.

Most of the acreage of this soil is used for crops. Only a small acreage is in grass. Most of the cultivated areas are irrigated.

This soil is suited to dryfarmed corn, grain sorghum, small grains, alfalfa, and grasses. Maintaining fertility and organic matter content are the principal concerns in management. Keeping crop residue on the surface, as in no-till planting, conserves moisture.

This soil is suited to irrigated corn, grain sorghum, soybeans, alfalfa, and introduced grasses. Both gravity and sprinkler systems are suitable. Land leveling and a tailwater recovery system improve surface drainage and increase the efficiency of gravity systems. Production can be sustained by applying commercial fertilizer, maintaining a high plant population, and using an efficient irrigation management system.

A few areas are in native grass. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil generally provides good sites for windbreaks. Weeds and grasses compete with trees for moisture. Seedlings survive and grow well if competing vegetation is controlled by cultivation between the rows with conventional equipment, such as a disc, and by hand hoeing, rototilling, or using appropriate herbicides within the rows.

The rare flooding limits use of this soil for sanitary facilities and buildings. There is a hazard of pollution of the ground water by effluent from filter fields. Sewage lagoons need to be diked as protection from flooding, and the bottom should be sealed to prevent seepage. Dwellings and buildings can be constructed on elevated, well compacted fill to protect them from flooding.

Constructing roads on suitable, well compacted fill above flood level and providing adequate side ditches and culverts help to prevent flood damage. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units I-1 dryland and I-6 irrigated, Silty Lowland range site, and windbreak suitability group 1.

CwB—Cozad silt loam, 1 to 3 percent slopes. This very gently sloping soil is on stream terraces of the Platte River valley. This soil is rarely flooded. It is deep and well drained. This soil formed in alluvium. The areas range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 7 inches thick. The subsoil is brown, friable silt loam about 5 inches thick. The underlying material is silt loam to a depth of 60 inches or more. The upper part of the underlying material is pale brown, and the lower part is very pale brown with thin strata of very fine sandy loam.

Included with this soil in mapping are small areas of Ortello soils in slightly higher positions than the Cozad soil. In some areas along the break between the stream terraces and adjacent bottom lands are soils that have a perched seasonal high water table at a depth of about 4 to 6 feet. The included soils make up about 5 to 12 percent of this map unit.

Permeability is moderate, and available water capacity is high. Runoff is slow. Organic matter content is moderately low, and natural fertility is medium. Tilth is good, and this soil can be easily tilled within a fairly wide range for moisture content. The water intake rate is moderate.

Most of the acreage of this soil is used for crops. A few small areas are in native grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, and small grains. Grasses and alfalfa can be grown for hay and pasture. The principal concerns in management are maintaining an adequate supply of moisture, controlling erosion, and maintaining fertility. Conservation

tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, reduces erosion and prevents loss of moisture.

This soil is suited to irrigated corn, grain sorghum, soybeans, and alfalfa. Both gravity and sprinkler systems are suitable. Land leveling and a tailwater recovery system are generally needed for gravity systems. Conservation tillage, which leaves crop residue on the surface as in no-till planting, conserves moisture. Irrigation water should be applied to meet the needs of the crop but it should be applied at a rate that permits the soil to absorb as much of the water as possible with the least runoff.

Only a small acreage of this soil is in native grass. The use of this soil for range controls erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival of adapted species is good, but weeds and grasses compete with trees for moisture. Competing vegetation can be controlled by cultivating between the rows with a disc or harrow and by using appropriate herbicides or rototilling within the rows.

The rare flooding limits use of this soil for sanitary facilities and buildings. There is a hazard of pollution of the ground water by effluent from filter fields. Sewage lagoons need to be diked as protection from flooding, and the bottom should be sealed to prevent seepage. Dwellings and buildings can be constructed on elevated, well compacted fill above flooding.

Constructing roads on suitable, well compacted fill above flood level and providing adequate side ditches and culverts help to prevent flood damage. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIe-1 dryland and IIe-6 irrigated, Silty Lowland range site, and windbreak suitability group 1.

Cx—Cozad silt loam, wet substratum, 0 to 1 percent slopes. This nearly level soil is on bottom lands. It is rarely flooded. This soil is deep and moderately well drained. It formed in alluvium. The areas range from 10 to 120 acres in size.

Typically, the surface layer is gray, very friable silt loam about 5 inches thick. The subsurface layer is dark gray, very friable silt loam about 5 inches thick. The subsoil is grayish brown, very friable silt loam about 5 inches thick. The upper part of the underlying material is grayish brown loam, the middle part is light brownish gray silt loam, and the lower part is light brownish gray, mottled, calcareous loam to a depth of 60 inches or more. In some places, the underlying material has thin strata of finer textured material.

Included with this soil in mapping are small areas of Alda soils. Alda soils have gravelly sand between depths of 20 and 40 inches, are generally calcareous above a depth of 10 inches, and are in slightly lower positions. The included soils make up 5 to 12 percent of this map unit.

Permeability is moderate, and available water capacity is high. Organic matter content is moderate, and natural fertility is medium. The surface layer is very friable and can be easily tilled. This soil has a seasonal high water table at a depth of about 4 feet in most wet years to about 6 feet in most dry years. The water intake rate is moderate.

Nearly all of the acreage of this soil is farmed. Most areas are irrigated.

This soil is suited to dryfarmed corn, grain sorghum, alfalfa, and small grains. Maintaining fertility, organic matter content, and soil moisture are the main concerns in management. Conservation tillage, which leaves all or part of the crop residue on the surface as in stubble mulching of small grains or no-till planting of row crops, conserves soil moisture and organic matter and helps to maintain fertility.

This soil is suited to irrigated corn, sorghum, soybeans, and alfalfa. Either gravity or sprinkler systems are suitable. Generally, some land leveling and a tailwater recovery system are necessary for gravity irrigation. Leveling also improves surface drainage. Irrigation water should be applied in correct quantities and at proper rate. Conservation tillage, which leaves crop residue on the surface, conserves soil moisture and organic matter.

The use of this soil for range controls wind erosion effectively. Overgrazing, haying at the wrong time, and cutting the grasses too short reduce the protective cover and cause the native vegetation to deteriorate. Deferment of grazing or haying and restricting use during very wet periods help to keep the native plants in good condition.

This soil is suited to trees and shrubs for windbreaks. Seedlings generally survive and grow if competing weeds and grasses are controlled by timely cultivation between the rows and careful use of appropriate herbicides or rototilling within the rows.

This soil is not suitable for septic tank absorption fields, dwellings, or buildings because of the flooding. Other sites should be found. Sewage lagoons need to be lined or sealed to prevent seepage. Lagoons also must be constructed on fill to raise the bottom of the lagoon above the seasonal high water table, and they need to be diked as protection from flooding.

Constructing roads on suitable, well compacted fill above flood level and providing adequate side ditches and culverts help to prevent wetness and flooding. Damage to roads by frost action can be reduced by good surface drainage and by a gravel moisture barrier

in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units I-1 dryland and I-6 irrigated, Silty Lowland range site, and windbreak suitability group 1.

Cy—Crete silt loam, 0 to 1 percent slopes. This nearly level soil is on flats or in slight depressions of the uplands. It is deep and moderately well drained. This soil formed in loess. The areas range from 5 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is 19 inches thick. It is grayish brown, friable silty clay loam in the upper part; brown, firm silty clay in the middle part; and pale yellow, friable light silty clay loam in the lower part. The underlying material is light gray, calcareous silt loam to a depth of 60 inches or more. In some areas, the combined thickness of the surface and subsurface layers is less than 10 inches because of cuts made during land leveling.

Included with this soil in mapping are small areas of nearly level Butler and Holder soils. Butler soils are somewhat poorly drained and are in slightly lower positions than the Crete soil. Holder soils have less clay in the subsoil and are in slightly higher positions. Also included are areas where the lighter colored subsoil has been exposed at the surface by land leveling. The included soils make up about 5 to 12 percent of this map unit.

Permeability is slow. Available water capacity is high, but moisture is released to plants slowly. Runoff is slow. Organic matter content is moderate, and natural fertility is high. Tilth is generally good in the friable surface layer. However, tilth is poor and organic-matter content is low where deep cuts were made during land leveling. The shrink-swell potential is moderate in the surface layer and high in the subsoil. The water intake rate is low.

Most of the acreage of this soil is cultivated. Some small areas are in native grasses for grazing.

This soil is suited to dryfarmed grain sorghum and small grains. Grasses and alfalfa can be grown for hay and pasture. The principal concern in management is maintaining fertility, organic matter content, and soil moisture. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, permits planting without excessive cultivation or loss of moisture. Green manure crops help to maintain the organic matter content and improve fertility, tilth, and water intake. Deep-rooted legumes, such as alfalfa, in the cropping sequence open the compacted layers and the clayey subsoil, thus improving water movement.

This soil is suited to irrigated corn, grain sorghum, soybeans, and alfalfa. Both gravity and sprinkler irrigation systems are suitable. Generally some land leveling and a tailwater recovery system are needed for gravity irrigation. Irrigation water should be applied to meet the needs of the crops but it should be applied at a rate that permits the soil to absorb as much of the water as possible with the least runoff. Production can be sustained by applying fertilizer, maintaining a high plant population, and using an efficient irrigation system. Conservation tillage, which leaves crop residue on the surface, improves soil tilth and water intake.

This soil is suited to range. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil is suited to trees and shrubs for windbreaks. If competing vegetation is controlled or removed by good site preparation and timely cultivation, the seedlings generally survive. Irrigation may be needed until seedlings are established or during prolonged droughts.

Septic tank absorption fields do not function well in this soil because of the slow permeability. This problem can be overcome by enlarging the filter field or using another kind of system. Generally, other sites should be found. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. The base material for roads can be mixed with additives, such as hydrated lime, to reduce shrinking and swelling.

This soil is in capability units IIs-2 dryland and IIs-2 irrigated, Clayey range site, and windbreak suitability group 4L.

De—Detroit silt loam, 0 to 1 percent slopes. This nearly level soil is on margins of upland basins. It is deep and moderately well drained. This soil formed in alluvium and loess. The areas are long and slender and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 12 inches thick. The subsoil is about 20 inches thick. It is dark grayish brown, firm silty clay loam in the upper part and pale brown, firm silty clay loam in the lower part. The underlying material is light brownish gray silty clay loam to a depth of 60 inches or more. In places, the subsoil has less clay.

Included with this soil in mapping are small areas of Butler soils. Butler soils have an abrupt increase in clay from the surface soil to the subsoil and are more poorly drained than the Detroit soil. They are at slightly lower positions. The included soils make up about 5 to 10 percent of this map unit.

Permeability is slow, and available water capacity is high. These soils absorb water readily and release it to plants readily. Runoff is slow. Organic matter content is moderate, and natural fertilty is high. The surface layer is friable and can be easily tilled within a fairly wide range of moisture content. The water intake rate is moderately low.

Nearly all of the acreage of this soil is cultivated. Most areas are irrigated.

This soil is suited to dryfarmed corn, grain sorghum, small grains, and alfalfa. The main concern in management is maintaining fertility and organic matter content. Conservation tillage, which leaves all or part of the crop residue on the surface as in no-till planting and stubble mulching, reduces erosion and conserves moisture.

This soil is suited to irrigated corn, grain sorghum, alfalfa, and soybeans using either gravity or sprinkler systems. Some land leveling and a tailwater recovery system are generally needed for gravity irrigation. Conservation tillage, which leaves crop residue on the surface, helps to control wind erosion. Irrigation water should be applied to meet the needs of the crops but it should be applied at a rate that permits the soil to absorb as much of the water as possible with the least runoff.

This soil is suited to range. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival and growth of adapted species is generally good. Weeds and grasses compete with trees for moisture. Good site preparation and timely cultivation between tree rows increase available moisture for the trees. Careful use of appropriate herbicides and rototilling help to control weeds and grasses within the rows.

The slow permeability of this soil limits functioning of septic tank absorption fields, but this problem can generally be overcome by increasing the size of the absorption field or by using another kind of system. Sewage lagoons need to be lined or sealed to prevent seepage. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base material provides the needed strength.

This soil is in capability units I-1 dryland and I-4 irrigated, Silty Lowland range site, and windbreak suitability group 1.

Dt—Detroit silt loam, terrace, 0 to 1 percent slopes. This nearly level soil is on stream terraces. It is rarely flooded. This soil is deep and moderately well drained. It formed in silty alluvium. The areas range from 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 11 inches thick. The subsoil is about 38 inches thick. It is dark grayish brown, friable silty clay loam in the upper part; dark grayish brown, firm silty clay in the middle part; and pale brown, friable silty clay loam in the lower part. The underlying material is very pale brown silt loam to a depth of 60 inches. In places, the subsoil has less clay or more clay.

Included with this soil in mapping are small areas of Hobbs and Hord soils. Hobbs soils contain less clay than the Detroit soil, are stratified, are occasionally flooded, and are in lower positions. Hord soils contain less clay. The included soils make up less than 10 percent of this map unit.

Permeability is slow. Available water capacity is high, and moisture is released to plants readily. Runoff is slow. Natural fertility is high, and organic matter content is moderate. Tilth is good, and this soil can be tilled within a fairly wide range of moisture content. The water intake rate is moderately low.

Most of the acreage of this soil is cultivated. Most cultivated areas are irrigated. A few areas are dryfarmed or are in grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, small grains, and alfalfa. The principal concern in management is maintaining fertility, organic matter content, and moisture. Conservation tillage, which leaves all or part of the crop residue on the surface as in no-till planting and stubble mulching, reduces erosion and conserves moisture.

This soil is suited to irrigated corn, grain sorghum, soybeans, and alfalfa using either gravity or sprinkler systems. Some land leveling and a tailwater recovery system are generally needed for gravity irrigation. Conservation tillage, which leaves crop residue on the surface, helps to control erosion. Irrigation water should be applied to meet the needs of the crops, but it should be applied at a rate that permits the soil to absorb as much water as possible with the least runoff.

This soil is suited to range. Overgrazing by livestock reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in water erosion. Deferment of grazing and haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival and growth of adapted species is generally good. Weeds and grasses compete with trees for moisture. Good site preparation and timely cultivation between tree rows increases available moisture for the trees. Careful use of appropriate herbicides and rototilling controls weeds and grasses within the rows.

Septic tank absorption fields do not function well in this soil because of the slow permeability. This problem

can be overcome by enlarging the filter field or using another kind of system. Generally, other sites should be found. Sewage lagoons need to be diked as protection from flooding.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Constructing roads on suitable, well compacted fill above flood level and providing adequate side ditches and culverts help to prevent flood damage.

This soil is in capability units I-1 dryland and I-4 irrigated, Silty Lowland range site, and windbreak suitability group 1.

DtB—Detroit silt loam, terrace, 1 to 3 percent slopes. This very gently sloping soil is on foot slopes and on low convex areas of stream terraces. It is deep and moderately well drained. This soil formed in silty alluvium. The areas range from 20 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 12 inches thick. The subsoil is grayish brown, firm silty clay loam in the upper part; brown, firm silty clay in the middle part; and brown, friable silty clay loam in the lower part. The subsoil is about 34 inches thick. The underlying material is brown silty clay loam to a depth of 60 inches or more. In places, there is less clay in the subsoil.

Included with this soil in mapping are small areas of Holder soils. Holder soils have less clay in the subsoil and are better drained than the Detroit soil. Holder soils are in slightly higher positions. The included soils make up less than 10 percent of this map unit.

Permeability is slow. Available water capacity is high, and moisture is released to plants readily. Runoff is medium. Natural fertility is high, and organic matter content is moderate. Tilth is good, and this soil can be tilled within a fairly wide range of moisture content. The water intake rate is moderately low.

Most of the acreage of this soil is cultivated. Most areas are irrigated. A few areas are dryfarmed and a few are in native grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, small grains, and alfalfa. The principal concerns in management are maintaining an adequate supply of moisture, reducing erosion, and maintaining fertility. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, reduces erosion and conserves moisture.

This soil is suited to irrigated corn, grain sorghum, and soybeans. Grasses and alfalfa can be grown for hay or pasture. Both gravity and sprinkler systems are suitable. Land leveling and a tailwater recovery system are generally needed for gravity irrigation. Crop residue can be left on the surface to reduce wind erosion. Row crops can be grown continuously if a high level of management is used and a high level of fertility is maintained. Irrigation water should be applied to meet the needs of the crop, but it should be applied at a rate that permits the soil to absorb as much of the water as possible with the least runoff.

This soil is suited to range. A permanent plant cover controls water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in water erosion. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival and growth of adapted species is good. Limited rainfall is the main problem. If competing vegetation is controlled or removed by good site preparation and timely cultivation, the seedlings generally survive. Using appropriate herbicides and rototilling control undesirable grasses and weeds within the rows.

The slow permeability of this soil limits functioning of septic tank absorption fields, but this problem can generally by overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage, and grading may be required to modify the slope and shape the lagoon. Foundations for buildings need to be strengthened and backfilled with coarse materials to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed drainage. Damage to roads by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIe-1 dryland and IIe-4 irrigated, Silty Lowland range site, and windbreak suitability group 1.

Fm—Fillmore silt loam, 0 to 1 percent slopes. This nearly level claypan soil is in shallow depressions or basins of the uplands. Water is ponded for several weeks after heavy rains. This soil is deep and poorly drained. It formed in loess. The areas are irregular, oblong, or oval and range from 5 to 100 acres in size.

Typically, the surface layer is gray, friable silt loam about 9 inches thick. The subsurface layer is light gray, friable silt loam about 4 inches thick. The subsoil is about 40 inches thick. It is gray, very firm clay in the upper part; grayish brown, firm silty clay in the middle part; and light brownish gray, firm silty clay loam in the lower part. The underlying material is light brownish gray, calcareous silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Butler and Scott soils. The better drained Butler soils are

in slightly higher positions. The more poorly drained Scott soils are in slightly lower positions. The included soils make up about 3 to 10 percent of this map unit.

Permeability is very slow. Available water capability is high, but moisture is released to plants only slowly. Runoff is very slow, and water ponds. Unless the soil is artificially drained, the water is removed principally by evaporation. Organic matter content is moderate, and natural fertility is medium. Tilth is fair. The shrink-swell potential is moderate in the surface layer and high in the subsoil. The seasonal high water table is near or above the surface from April through July. The water intake rate is low.

Most of the acreage of this soil is cultivated. Some small areas are in native grasses for grazing and hay.

This soil is suited to dryfarmed grain sorghum and wheat. The main problem is ponding. The excess water delays tillage and can retard crop growth. Crops fail about 2 years out of every 5. Ponding can be reduced by surface drainage and by intercepting runoff from higher areas with terraces and diversions. This soil puddles if tilled when too wet. Conservation tillage, which leaves crop residue on the surface, improves tilth and water intake.

This soil is suited to irrigated corn, grain sorghum, and soybeans if adequate outlets for surface drainage are available or if the areas are graded. Both gravity and sprinkler irrigation systems are suitable. Irrigation water should be applied to meet the needs of the crops; but it should be applied at a rate that permits the soil to absorb as much water as possible without ponding. Conservation tillage, which leaves crop residue on the surface, improves tilth and water intake.

This soil is suited to range. Overgrazing by livestock and deposition of silt reduce the protective cover and causes the native vegetation to deteriorate. Grazing when the soil is wet causes surface compaction. Deferment of grazing helps to maintain or improve the range condition.

This soil provides poor sites for windbreaks. Survival and growth are only fair. Ponding retards growth or can drown seedlings unless they are planted on fill or surface drainage is provided. Undesirable grasses and weeds can be controlled by cultivating between the rows and by rototilling or using carefully selected herbicides within the rows.

Septic tank absorption fields are not suited to this soil because of the very slow permeability and ponding. Other sites should be found. Sewage lagoons must be constructed on fill to raise the bottom of the lagoon above the perched seasonal high water table. Dwellings and buildings can be constructed on raised, well compacted fill above the perched high water table. Foundations for buildings need to be strengthened and backfilled with coarser materials to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Coarse-grained material for the subgrade or base provides the needed strength. Constructing roads on suitable, well compacted fill above the ponding level and providing adequate side ditches and culverts help to prevent damage by ponded water. Damage to roads by frost action can be reduced by good surface drainage and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. The base material for roads can be mixed with additives, such as hydrated lime, to reduce shrinking and swelling.

This soil is in capability units IIIw-2 dryland and IIIw-2 irrigated, Clayey Overflow range site, and windbreak suitability group 2W.

Fo—Fillmore silt loam, drained, 0 to 1 percent slopes. This nearly level claypan soil is on uplands. It is deep and somewhat poorly drained. This soil formed in loess. Areas of this soil were originally poorly drained or very poorly drained depressions or basins. They have been drained by filling and land smoothing. Providing adequate surface drainage by grading is common in development for irrigation. The areas range from 5 to 40 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 6 inches thick. The subsurface layer is about 28 inches thick. It is grayish brown, friable silt loam in the upper part and light gray, very friable silt loam in the lower part. The subsoil is about 23 inches thick. It is dark gray, very firm clay in the upper part; grayish brown, very firm clay in the middle part; and grayish brown, firm silty clay loam in the lower part. The underlying material is very pale brown, calcareous silt loam to a depth of 60 inches or more. In places, the combined thickness of the dark surface and subsurface layers is less than 10 inches.

Included with this soil in mapping are small areas of Butler and Crete soils. Butler soils have a less distinct subsurface horizon, are somewhat poorly drained, and are in higher positions than the Fillmore soil. Crete soils do not have a distinct gray subsurface layer, have a browner subsoil, are moderately well drained, and are in slightly higher positions than the Fillmore soil. Also included are some areas where the clayey subsoil of the Fillmore soil has been exposed at the surface by land leveling. The included soils make up about 5 to 15 percent of this map unit.

Permeability is very slow. Available water capacity is high, but moisture is released to plants only slowly. Runoff is slow. Organic matter content is moderate, and natural fertility is medium. Tilth is fair. The shrink-swell potential is moderate in the surface layer and high in the subsoil. The perched seasonal high water table is at a

depth of about 1 to 3 feet, mainly from April through July. The water intake rate is low.

Most of the acreage of this soil is used for irrigated crops. Some small areas are dryfarmed.

This soil is suited to dryfarmed grain sorghum and wheat. The principal problems are wetness in spring and droughtiness in late summer. The slowly permeable subsoil keeps the surface layer saturated during wet seasons; the wetness delays tillage and retards crop growth. The soil puddles if tilled when wet. Conservation tillage, which leaves crop residue on the surface, reduces compaction, conserves soil moisture, and protects the surface from wind erosion during dry seasons. Keeping residue on the surface also improves tilth and water intake.

This soil is suited to irrigated corn, grain sorghum, alfalfa, and soybeans. Drainage can be improved by land leveling and by a drainage ditch where an adequate outlet is available. Either gravity or sprinkler systems are suitable. The slowly permeable subsoil keeps the surface layer saturated during wet seasons, delaying tillage and retarding crop growth. This soil puddles if tilled when wet. Irrigation water should be applied to meet the needs of the crop, but it should be applied at a rate that permits the soil to absorb as much water as possible with the least runoff. Conservation tillage, which leaves crop residue on the surface, improves tilth and water intake.

This soil is suited to range. Overgrazing by livestock and deposition of silt reduce the protective cover and causes the native vegetation to deteriorate. Grazing when the soil is wet causes surface compaction. Deferment of grazing helps to maintain or improve the range condition.

For windbreaks, this soil is suited to trees and shrubs that are moderately resistant to drought. Limited rainfall and seasonal wetness cuased by the very slow permeability of the subsoil are the main problem. Irrigation may be needed until seedlings are established or during prolonged droughts. Seedlings generally survive and grow if competing vegetation is controlled or removed by good site preparation, timely cultivation between rows, and careful use of selected herbicides or rototilling within the rows.

Septic tank absorption fields are not suited to this soil because of the wetness and very slow permeability. Other sites should be found. Sewage lagoons must be constructed on fill material to raise the bottom of the lagoon above the perched seasonal high water table. Dwellings and buildings also should be constructed on raised, well compacted fill above the perched high water table. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Constructing roads on suitable, well compacted fill and providing adequate side ditches and culverts help to prevent flood damage and wetness. Damage to roads by frost action can be reduced by good surface drainage and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. The base material for roads can be mixed with additives, such as hydrated lime, to reduce shrinking and swelling.

This soil is in capability units IIw-2 dryland and IIw-2 irrigated, Clayey range site, and windbreak suitability group 4L.

Fv—Fonner Variant loamy sand, 0 to 2 percent slopes. This nearly level soil is on bottom lands. It is occasionally flooded. This soil is shallow over coarse sand and is moderately well drained. It formed in sandy alluvium. The areas range from 10 to 60 acres in size.

Typically, the surface layer is grayish brown, very friable loamy sand about 6 inches thick. The next layer is light brownish gray sand about 5 inches thick. The upper 8 inches of the underlying material is very pale brown sand, and the lower part is very pale brown coarse sand to a depth of 60 inches. In some small areas in swales and microdepressions, the surface layer is loam.

Included with this soil in mapping are small areas of Inavale soils in slightly higher positions than the Fonner variant soil. Inavale soils are somewhat excessively drained. The included soils make up 5 to 10 percent of this map unit.

Permeability is rapid in the upper part of the underlying material and very rapid in the lower part. The available water capacity is low. Organic matter content and natural fertility are low. Roots of common crops are generally restricted to the soil material above the coarse sand. The seasonal high water table is at a depth of 3 feet in most wet years and 5 feet in most dry years.

Most of the acreage of this soil is in native grasses and are used for range. Some areas have a 50 to 70 percent cover of eastern redcedar.

This soil is poorly suited to dryfarmed crops. It is best suited to small grains and grain sorghum because they mature before the hot weather of the summer. The principal concerns in management are wind erosion and the low moisture supply because of the coarse texture of the lower part of the profile. Conservation tillage, which leaves most or all of the crop residue on the surface as in stubble mulching, conserves moisture and reduces wind erosion.

This soil is poorly suited to irrigated crops such as corn, sorghum, and alfalfa. Only sprinkler systems are suitable. Because of the very rapid permeability of the coarse underlying material and the low available water capacity, applications of irrigation water and fertilizer must be light but frequent. Wind erosion is a hazard on

unprotected fields. Conservation tillage, which leaves crop residue on the surface, reduces wind erosion and conserves moisture. Conservation tillage includes plowing with a disc or chisel, no-till planting, or stubble mulching. Keeping crop residue on the surface and applying commercial fertilizer and barnyard manure help to maintain fertility and improve organic matter content.

Use of this soil for range controls wind erosion effectively. Overgrazing reduces the protective cover and causes the range vegetation to deteriorate. Deferment of grazing helps to maintain or improve the range condition.

This soil provides fair sites for windbreaks. Survival and growth of adapted species is only fair. Species should be selected that tolerate moderate wetness in spring and droughtiness in late summer. Supplemental water may be needed when rainfall is insufficient.

This soil is not suitable for septic tank absorption fields or buildings because of the flooding. Other sites should be found. Sewage lagoons can be constructed on fill material so that the bottom of the lagoon is above the seasonal high water table. Sewage lagoons need to be lined or sealed to prevent seepage and need to be diked for protection from flooding. Dwellings and buildings can be constructed on elevated, well compacted fill as protection against flooding.

Constructing roads on suitable, well compacted fill and providing adequate side ditches and culverts help to prevent flood damage and wetness. Damage to roads by frost action can be reduced by good surface drainage and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IVs-4 dryland and IVs-14 irrigated, Sandy Lowland range site, and windbreak suitability group 2S.

GeF—Geary silt loam, 11 to 30 percent slopes. This steep soil is on upland side slopes. This soil is deep and somewhat excessively drained. It formed in loess. The areas range from 10 to 200 acres in size.

Typically, the surface layer is brown, very friable silt loam about 7 inches thick. The subsoil is brown, friable silty clay loam in the upper part; light brown, friable silty clay loam in the middle part; and light brown, very friable silt loam in the lower part. The subsoil is about 29 inches thick. The underlying material is light gray, calcareous silt loam to a depth of 60 inches or more. Masses of soft lime are in the underlying material.

Included with this soil in mapping are small areas of Uly soils in higher positions and Hobbs soils on the bottom lands of narrow drainageways. Uly soils generally have less clay in the subsoil, and their underlying material is less reddish. Hobbs soils are stratified, generally contain less clay throughout, and are occasionally flooded. The included soils make up 10 to 15 percent of this map unit.

Permeability is moderately slow. Available water capacity is high, and moisture is released to plants readily. Runoff is rapid. Organic matter content is moderate, and natural fertility is medium.

Nearly all of the acreage of this soil is in native grasses for grazing. Some small, isolated areas are used for dryfarmed crops.

This soil is not suited to farming, either dryland or irrigated, because it is too steep and erodible. A good grass cover reduces runoff and erosion. The few cultivated areas are severely eroded; they should be planted to native grasses for grazing. Dams for livestock water, erosion-control structures, and flood retention reservoirs can be built in some of the drainageways.

This soil is suited to range. A permanent grass cover controls water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing can also result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil is too steep and erodible for windbreaks. In a few places, trees can be planted by hand, but they need special tending.

This soil generally is not suitable for sanitary facilities because of the slope. Other sites should be found. Dwellings and small buildings can be designed to fit the slope, or the soil can be graded to an acceptable slope.

Cuts and fills are generally needed to provide a suitable grade for roads. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability unit VIe-1 dryland, Silty range site, and windbreak suitability group 10.

GhD2—Geary silt clay loam, 6 to 11 percent slopes, eroded. This strongly sloping soil is on the lower part of upland side slopes. It is deep and well drained. This soil formed in reddish brown loess. The areas range from 10 to 60 acres in size.

Typically, the surface layer is brown, firm silty clay loam about 5 inches thick. The subsoil is brown, firm silty clay loam about 22 inches thick. The underlying material is reddish yellow, calcareous silt loam to a depth of 60 inches. Over most of the area, the original surface layer has been removed by erosion, and tillage has mixed the rest with the upper part of the subsoil. Small rills are common after rains.

Included with this soil in mapping are small areas of Holder soils in higher positions and Hobbs soils on the bottom land of narrow drainageways. Holder soils are less red than the Geary soil. Hobbs soils are stratified, contain less clay throughout, and are occasionally

flooded. The included soils make up less than 10 pecent of this map unit.

Permeability is moderately slow. Available water capacity is high, and moisture is released to plants readily. Runoff is rapid. Organic matter content is moderately low, and natural fertility is low. Tilth is generally poor because of the moderately low content of organic matter and the high content of clay in the eroded surface layer. This soil can be tilled only within a narrow range of moisture content. The shrink-swell potential is moderate. The water intake rate is low.

Nearly all of the acreage of this soil is cultivated. A few areas have been seeded to introduced grasses and are used for grazing.

This soil is suited to dryfarmed grain sorghum, small grains, and alfalfa. The main problem is the hazard of water erosion. Runoff and water erosion can be controlled by terraces, grassed waterways, and contour farming. Conservation tillage, which leaves crop residue on the surface, is particularly effective in controlling erosion. Also effective is a cropping system that keeps the soil covered with crops or crop residue most of the time by limiting row crops and using mostly close-growing crops in the rotation. Small gullies can be shaped and seeded to grass. Grassed field borders help to control runoff and can be used as turn rows, roadways, and wildlife habitat. In the hot, dry summer, crops can be damaged by a lack of adequate moisture.

Alfalfa and introduced grasses are suitable for irrigated farming. Row crops, such as corn and sorghum, are not suitable because water management is difficult and erosion is a severe hazard. Sprinkler irrigation is the only method suited to this soil. Terraces, contour farming grassed waterways, and a mulch of crop residue, help to control water erosion. The rate at which water can be applied is limited by the low intake rate of the soil.

This soil is suited to range. A permanent grass cover controls water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferring grazing or haying helps to maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded areas.

This soil is suited to trees and shrubs for windbreaks, but care is needed to control erosion. Terraces and contour planting help to prevent erosion. Survival and growth are fair. Weeds and grasses can be controlled by cultivating between the rows with conventional equipment, such as a disc. Within the rows, appropriate herbicides can be used or the areas can be hoed by hand or rototilled.

Because of the moderately slow permeability of this soil, septic tank absorption fields should be larger than usual for best results. Reshaping the land and installing the lines on the contour are generally necessary for proper operation of the absorption field. Sites for sewage lagoons must be graded to modify the slope and shape the lagoon. Dwellings and small buildings can be designed to fit the slope, or the soil can be graded to an acceptable slope.

Cuts and fills are generally needed to provide a suitable grade for roads. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches and culverts help to provide the needed surface drainage.

This soil is in capability units IVe-8 dryland and IVe-3 irrigated, Silty range site, and windbreak suitability group 3.

GhE2—Geary silty clay loam, 11 to 17 percent slopes, eroded. This moderately steep soil is on ridgetops and side slopes of uplands. It is deep and well drained. It formed in reddish brown loess. The areas are generally long and narrow and range from 10 to 50 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 5 inches thick. The subsoil is light brown, friable silty clay loam about 7 inches thick. The underlying material is light brown, calcareous silt loam to a depth of 60 inches or more. Soft masses of calcium carbonate are in the underlying material in many places. Most of the original dark surface layer has been removed by erosion, and tillage has mixed the remainder with subsoil material. Rills are common after heavy rains. In places the underlying material is at the surface. In some areas, the surface layer is darker than is typical and is more than 5 inches thick; in other areas, the surface layer is light brown or pinkish gray.

Included with this soil in mapping are small areas of Hobbs soils on the bottom lands of narrow drainageways and Holder soils in higher positions. Hobbs soils are stratified, contain less clay throughout, and are occasionally flooded. Holder soils are less red. The included soils make up about 3 to 8 percent of this map unit.

Permeability is moderate slow. Available water capacity is high. Runoff is rapid. Organic matter content is moderately low, and natural fertility is low. Tilth is poor. This soil is easy to till only within a narrow range for moisture content. The shrink-swell potential is moderate.

Nearly all of the acreage of this soil is in dryfarmed crops. A few areas have been seeded to grasses and are used for grazing.

This soil is not suited to cultivated crops, either dryfarmed or irrigated, because it is too steep and erodible. This soil can be seeded to native grasses for grazing.

This soil is suited to range. A permanent grass cover controls water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the

grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded areas. Growth is commonly slower on this soil than on less sloping soils.

This soil is suitable for trees and shrubs for windbreaks, but care is needed to control erosion. Contour planting and terraces help to prevent water loss and erosion. Survival and growth are only fair. Seedlings generally survive if competing vegetation is controlled or removed by good site preparation and timely cultivation.

This soil generally is not suitable for sanitary facilities because of the slope. Other sites should be found. Dwellings and small buildings can be designed to fit the slope, or the soil can be graded to an acceptable slope.

Cuts and fills are generally needed to provide a suitable grade for roads. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability unit VIe-8 dryland, Silty range site, and windbreak suitability group 3.

Gt—Gothenburg sandy loam, 0 to 2 percent slopes. This nearly level soil is on bottom lands. The areas are dissected by shallow stream channels and are frequently flooded by the Platte River. This soil is very shallow over coarse sand or gravelly sand and is poorly drained. It formed in sand and gravelly alluvium. The areas are generally elongated and range from 20 to 500 acres in size.

The surface layer is dark gray, very friable, calcareous sandy loam about 3 inches thick. The upper part of the underlying material is light gray fine sand about 6 inches thick. The lower part is light gray, mottled gravelly sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of somewhat poorly drained Platte soils in slightly higher positions. The included soils make up 10 to 25 percent of this map unit.

Permeability is very rapid, and available water capacity is very low. Runoff is slow. Natural fertility is low, and organic matter content is very low. Roots of common crops are generally restricted to the soil material above the gravelly sand. The seasonal high water table is at the surface in most wet years and at a depth of about 2 feet in most dry years.

Most of the acreage of this soil is used as habitat for woodland and wetland wildlife. These areas are also commonly grazed but have small value for this purpose.

This soil is not suited to cultivated crops because of the very shallow depth to gravelly sand, very low available water capacity, and frequent flooding.

Use of this soil for grazing is limited. Annual grasses, sedges, weeds, shrubs, and cedar trees are the common vegetation. An adequate supply of water is available in the river channels during most seasons. This soil provides suitable sites for excavated ponds for watering livestock.

This soil is not suited to trees or shrubs for windbreaks. The principal native trees on this soil are eastern cottonwood and eastern redcedar. On this soil, they are shallow rooted and subject to abuse during storms.

This soil is not suited to sanitary facilities because of the flooding, the high water table, and the possibility of contaminating the ground water. Other sites should be found for all sanitary facilities, dwellings, and buildings. This soil is a potential source of sand and gravel for construction, roadfill, and other uses.

Constructing roads above flood level on suitable, well compacted fill and providing adequate side ditches and culverts help to prevent flood damage and wetness. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading helps to provide the needed surface drainage.

This soil is in capability unit VIIs-3 dryland and windbreak suitability group 10.

Hc—Hastings silt loam, 0 to 1 percent slopes. This nearly level soil is on broad divides on the loess-mantled uplands. This soil is deep and well drained. This soil formed in loess. The areas range from 10 to 2,000 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 6 inches thick. The subsoil is about 16 inches thick. The upper part of the subsoil is dark grayish brown, friable silty clay loam; the middle part is brown, firm silty clay; and the lower part is yellowish brown, friable silty clay loam. The underlying material is pale brown silt loam to a depth of 60 inches or more. It is calcareous in the lower part. In places, the combined thickness of the dark surface and subsurface layers is more than 20 inches and the subsoil has less clay.

Included with this soil in mapping are small areas of nearly level Butler and Fillmore soils. Butler and Fillmore soils are more poorly drained than the Hastings soil and are in small basins or depressions unless the areas have been filled during land leveling. Also included are some areas where the lighter colored subsoil of the Hastings soil has been exposed at the surface by land leveling for irrigation. The included soils make up about 8 to 15 percent of this map unit.

Permeability is moderately slow. Available water capacity is high, and moisture is released to plants readily. Runoff is slow. Organic matter content is moderate, and natural fertility is high. Tilth is generally good in the friable surface layer. The shrink-swell

Figure 5.—Gravity-irrigated corn on Hastings silt loam, 0 to 1 percent slopes.

potential is moderate in the surface layer and high in the subsoil. The water intake rate is moderately low.

Most of the acreage of this soil is used for crops. Some small areas are in native grasses for grazing.

This soil is suited to dryfarmed grain sorghum and small grains. Grasses and alfalfa can be grown for hay and pasture. The primary concerns of management are maintaining fertility, conserving moisture, and reducing wind erosion. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, reduces wind erosion and prevents loss of soil moisture. Returning crop residue to the soil also helps to maintain and improve tilth and fertility.

This soil is suited to irrigated corn, grain sorghum, soybeans, and alfalfa. Both gravity and sprinkler irrigation systems are suitable (fig. 5). Land leveling and a tailwater recovery system are needed for gravity irrigation. Irrigation water should be applied to meet the needs of the crop, but it should be applied at a rate that permits the soil to absorb as much water as possible with the least runoff. Row crops can be grown continuously if a high level of management is used and fertility is maintained. Crop residue should be left on the surface in winter to reduce wind erosion and to catch snow.

This soil is suited to range. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in water erosion. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival and growth of adapted species is good. Weeds and grasses compete with trees for moisture. Good site preparation and timely cultivation between tree rows increase available moisture for trees. Careful use of selected herbicides and roto-tilling help to control weeds and grasses within the rows.

The moderately slow permeability of this soil limits functioning of septic tank absorption fields, but this

problem can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. The base material for roads can be mixed with additives, such as hydrated lime, to reduce shrinking and swelling. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units I-1 dryland and I-4 irrigated, Silty range site, and windbreak suitability group 3.

HcB—Hastings silt loam, 1 to 3 percent slopes. This very gently sloping soil is in convex areas and on side slopes of the uplands. This soil is deep and well drained. It formed in loess. The areas range from 10 to 300 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 5 inches thick. The subsurface layer is grayish brown, friable silt loam about 7 inches thick. The subsoil is friable silty clay loam about 20 inches thick. It is brown in the upper part and pale brown in the lower part. The underlying material is very pale brown silt loam in the upper part and light gray, calcareous silt loam in the lower part to a depth of 60 inches or more. In places, the subsoil has less clay. In some places, the combined thickness of the dark surface and subsurface layers is more than 20 inches.

Included with this soil in mapping are small areas where the lighter colored subsoil has been exposed at the surface by land leveling. These areas make up about 5 to 10 percent of this map unit.

Permeability is moderately slow. Available water capacity is high, and moisture is released to plants readily. Runoff is medium. Organic matter content is moderate, and natural fertility is high. Tilth is generally good, and the soil can be easily tilled within a fairly wide range of moisture content. However, tilth is poor and organic matter content is low where deep cuts were made during land leveling. The shrink-swell potential is moderate in the surface layer and high in the subsoil and underlying material. The water intake rate is moderately low.

Most of the acreage of this soil is used for crops, both irrigated and dryfarmed. Some small areas are in native grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, and small grains. Grasses and alfalfa can be grown for hay and pasture. The hazard of water erosion is the principal problem. The primary concerns in management are maintaining fertility, conserving moisture, and reducing water and wind erosion. Water erosion can be controlled by terraces, grassed waterways, and contour farming. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, reduces water and wind erosion and prevents loss of soil moisture.

The soil is suited to irrigated corn, grain sorghum, soybeans, and alfalfa. Either sprinkler or gravity systems are suitable. Some land leveling and a tailwater recovery system are generally needed for gravity irrigation. Irrigation water should be applied to meet the needs of the crop; but it should be applied at a rate that permits the soil to absorb as much water as possible with the least runoff. Row crops can be grown continuously if a high level of management is used and fertility is maintained. Keeping crop residue on the surface increases water intake and helps to prevent erosion.

This soil is suited to range. A permanent plant cover controls water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil is well suited to trees and shrubs for windbreaks. Seedlings generally survive and grow well if competing grasses and weeds are controlled by timely cultivation between the rows and by careful use of selected herbicides or rototilling within the rows. Irrigation provides supplemental moisture during periods of low rainfall.

The moderately slow permeability of this soil limits functioning of septic tank absorption fields, but this problem can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. The base material for roads can be mixed with additives, such as hydrated lime, to reduce shrinking and swelling. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIe-1 dryland and IIe-4 irrigated, Silty range site, and windbreak suitability group 3.

HdC2—Hastings silty clay loam, 3 to 6 percent slopes, eroded. This gently sloping soil is on side slopes of intermittent drainageways in the uplands. This soil is deep and well drained. It formed in loess. The areas range from 10 to 100 acres in size.

Typically, the surface layer is brown, firm silty clay loam about 5 inches thick. The subsurface layer is brown, firm silty clay loam about 3 inches thick. The subsoil is light yellowish brown silty clay loam about 5 inches thick. The underlying material is very pale brown silt loam to a depth of 60 inches or more. The lower part is calcareous. Most of the original surface layer has been removed by erosion, and tillage has mixed the rest with the upper part of the subsoil. Rills are common after heavy rains. In some areas, the depth to carbonates is less than 36 inches.

Included with this soil in mapping are small areas of Uly soils in lower positions. Uly soils have less clay in the subsoil than the Hastings soil and have carbonates higher in the profile. The included soils make up about 12 to 20 percent of this map unit.

Permeability is moderately slow. Available water capacity is high, and moisture is released to plants readily. Runoff is rapid. Natural fertility is low, and organic matter content is moderately low. Tilth is fair; this soil can be tilled only within a narrow range of moisture content. The shrink-swell potential is moderate. The water intake rate is low.

Nearly all of the acreage of this soil is used for crops. A few areas are irrigated. Some areas have been seeded to introduced grasses and are used for grazing.

This soil is suited to dryfarmed corn, grain sorghum, and small grains. Grasses and alfalfa can also be grown for hay and pasture. In hot, dry summers, crops can be damaged by lack of moisture. The principal problems are the hazard of water erosion and the limited precipitation. Runoff and water erosion can be controlled by terraces, grassed waterways, and contour farming. Conservation tillage, which leaves crop residue on the surface, reduces runoff and conserves moisture. Small gullies can be shaped and seeded to grass. Grassed field borders help to control runoff and can be used as turn rows, roadways, and wildlife habitat. This soil is deficient in both nitrogen and phosphorus. They can be supplied by commercial fertilizers and barnyard manure.

This soil is suited to irrigated corn, grain sorghum, alfalfa, and introduced grasses. This soil is better suited to sprinkler irrigation than to gravity systems. The principal hazards are water and wind erosion. Improving fertility and properly distributing the water are the important concerns in management. The rate at which water is applied should match the intake rate of the soil. Terraces, contour irrigation, grassed waterways, and crop residue on the surface reduce water and wind erosion. Nitrogen and phosphate are both needed and can be supplied by commercial fertilizer and barnyard manure.

This soil is suited to range. A permanent plant cover controls wind and water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded areas.

This soil is suited to trees and shrubs for windbreaks, but care is needed to control erosion. Terraces and contour planting help to prevent erosion and conserve surface moisture. Survival of adapted species is good and growth is fair if competing vegetation is controlled by cultivating between the rows and by using appropriate herbicides and rototilling within the rows.

The moderately slow permeability of this soil limits functioning of septic tank absorption fields, but this problem can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Foundations for buildings need to be strengthened and backfilled with coarse materials to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIIe-8 dryland and IIIe-3 irrigated, Silty range site, and windbreak suitability group 3.

HdD2—Hastings silty clay loam, 6 to 11 percent slopes, eroded. This strongly sloping soil is on side slopes of the uplands. This soil is deep and well drained. It formed in loess. The areas range from 10 to 60 acres in size.

Typically, the surface layer is grayish brown, firm silty clay loam about 6 inches thick. The subsoil is brown silty clay loam about 6 inches thick. The underlying material is very pale brown and pale brown silt loam to a depth of 60 inches or more. The lower part is calcareous. Over most of the area, the original darkened surface layer has been removed by erosion and the present surface layer is tilled subsoil material. In places, the underlying material is exposed at the surface. Rills are common after heavy rains. In some areas, the surface layer is darker and thicker. In places, the subsoil is thin and weakly developed. In places, the depth to free calcium carbonate is 20 to 36 inches.

Included with this soil in mapping are small areas of Geary and Uly soils. Those soils are in lower positions.

Geary soils have less clay in the subsoil than the Hastings soil, and they formed in reddish brown loess. Uly soils have less clay in the subsoil and have carbonates higher in the profile. The included soils make up 5 to 10 percent of this map unit.

Permeability is moderately slow. Available water capacity is high, and moisture is released to plants readily. Runoff is rapid. Natural fertility is low, and organic matter content is moderately low. The shrink-swell potential is moderate. Tilth is poor; the surface layer can be tilled only within a narrow range of moisture content. The water intake rate is low.

Nearly all of the acreage of this soil is used for dryfarmed crops. A few areas have been seeded to grasses and are used for grazing.

This soil is suited to dryfarmed corn, grain sorghum, small grains, and alfalfa. In hot, dry summers, crops can be damaged by lack of sufficient moisture. The principal problems are the hazard of water erosion and the limited precipitation. Runoff and water erosion can be controlled by terraces, grassed waterways, and contour farming. Conservation tillage, which leaves the soil covered by crop residue, controls erosion and runoff. Also effective is a cropping system that keeps the soil covered with crop or crop residue most of the time by limiting row crops and using mostly close-grown crops in the rotation. Small gullies can be shaped and seeded to grass. Grassed field borders help to control runoff and can be used as turn rows, roadways, and wildlife habitat.

Alfalfa and introduced grasses are suitable for irrigation. Row crops are not so well suited because water management is more difficult and erosion is a severe hazard. Terraces, contour irrigation, grassed waterways, and a mulch of crop residue help to control water erosion. Sprinkler irrigation is the only method suitable. Erosion by the combination of rainfall and irrigation water is difficult to control unless crop residue is kept on the surface. The rate at which water is applied should match the intake rate of the soil.

This soil is suited to range. A permanent plant cover controls wind and water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded areas.

This soil is suited to trees and shrubs for windbreaks. Survival of adapted species is good and growth is fair if competing vegetation is controlled by rototilling or carefully using appropriate herbicides within the rows or by cultivating between the rows. Contour planting and terraces reduce water loss and erosion.

Because of the moderately slow permeability and the slope of this soil, septic tank absorption fields should be larger than usual, lines should be laid on the contour, and control valves should be installed. For sewage lagoons, the land must be extensively graded to modify the slope and shape the lagoon. Dwellings and small buildings can be designed to fit the slope, or the soil can be graded to an acceptable slope. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IVe-8 dryland and IVe-3 irrigated, Silty range site, and windbreak suitability group 3.

He—Hobbs silt loam, 0 to 2 percent slopes. This nearly level soil is on bottom lands of intermittent drainageways and on high bottom lands adjacent to major streams. This soil is occasionally flooded, but the flood waters generally recede within a few hours (fig. 6). This soil is deep and well drained. It formed in silty alluvium. The areas range from 3 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown, very friable silt loam about 13 inches thick. The underlying material is silt loam to a depth of 60 inches or more. The upper part of the underlying material has a few thin, grayish brown and dark grayish brown strata; the middle part is light brownish gray; and the lower part is pale brown.

Included with this soil in mapping are small areas of Hord soils on rarely flooded stream terraces. Hord soils are not stratified. The included soils make up less than 5 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is slow. Organic matter content is moderate, and natural fertility is high. Tilth is good. The surface layer is very friable and can be tilled easily. The water intake rate is moderate.

Most of the acreage of this soil is cultivated. A few areas are in native grasses for grazing.

This soil is suited to dryfarmed corn, sorghum, small grains, and alfalfa. The principal problem is the occasional flooding. Production of small grains and alfalfa can be reduced by flooding, but during dry periods the additional moisture is beneficial to crops. Flooding can be reduced by diversions and drainage ditches to intercept runoff and keep it from spreading over a wide area. Conservation tillage, which leaves crop residue on the surface as in minimum tillage and stubble mulching, prevents wind erosion and excessive loss of moisture.

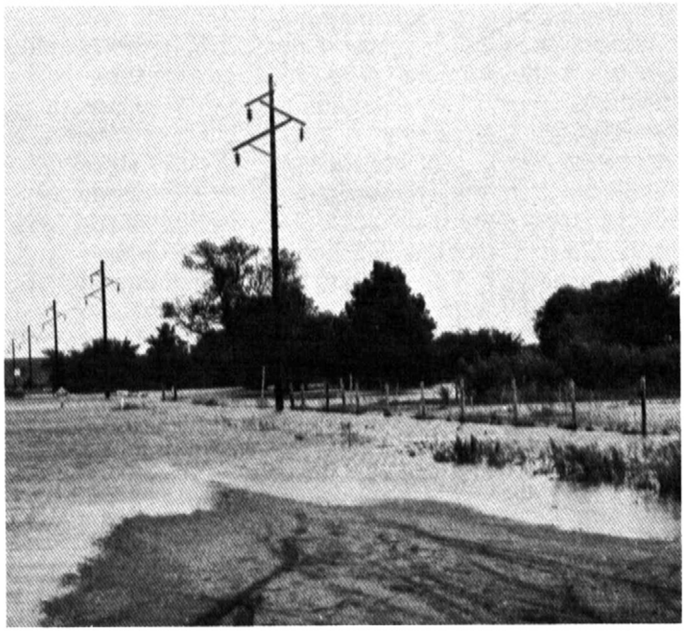

Figure 6.—Some areas of Hobbs silt loam, 0 to 2 percent slopes, are flooded after heavy rains.

This soil is suited to irrigated corn, sorghum, soybeans, and alfalfa. Either gravity or sprinkler systems are suitable. Land leveling and a tailwater recovery system are generally needed for gravity irrigation. Floodwater from higher soil areas should be diverted or intercepted. Conservation tillage, which leaves crop residue on the surface, helps to prevent wind erosion and excessive loss of moisture.

This soil is suited to range. Overgrazing by livestock and deposition of silt reduce the protective cover and cause the native vegetation to deteriorate. Deferment of grazing helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival and growth of adapted species are good. Competition for moisture from weeds and grasses can be controlled by good site preparation, timely cultivation between the rows, and careful use of selected herbicides and hoeing by hand or rototilling within the rows.

This soil is not suitable for septic tank absorption fields or buildings because of the flooding. Other sites should be found. Sewage lagoons need to be diked as protection from flooding.

Constructing roads above flood level on suitable, well compacted fill and providing adequate side ditches and culverts help to prevent flood damage. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIw-3 dryland and IIw-6 irrigated, Silty Overflow range site, and windbreak suitability group 1.

Hf—Hobbs silt loam, channeled. This soil is on bottom lands of perennial and intermittent drainageways. Many areas include short, steep streambanks or breaks to the bottom of the meandering channels. This soil is frequently flooded after heavy rains. It is deep and well drained. This soil formed in silty alluvium. The areas are 100 to 800 feet wide and 1 to 20 miles long, and they range from 5 to 600 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, friable silt loam with thin strata of coarser textured and lighter colored material; it is about 11 inches thick. The underlying material is stratified dark grayish brown and light brownish gray silt loam to a depth of 60 inches or more. In some small areas texture is loam or sandy loam.

Included with this soil in mapping are small areas of soils that are occasionally flooded. These soils are in slightly higher positions than the Hobbs soil. The included soils make up about 5 to 10 percent of this map unit.

Permeability is moderate, and available water capacity is high. Runoff is medium. Organic matter content is moderate, and natural fertility is medium. The water intake rate is moderate.

Nearly all of the acreage of this soil is in native grasses for range. A few small areas are in trees and are used as habitat for woodland wildlife.

The soil is not suitable for cultivation because it is frequently flooded and the long narrow areas are traversed by deep, meandering channels.

This soil is suited to range. Overgrazing by livestock and deposition of silt reduce the protective cover and causes the native vegetation to deteriorate. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil is not suited to trees or shrubs for windbreaks because of the frequent flooding and deep, meandering channels. Some areas have a good stand of volunteer trees and bushes.

This soil is not suitable for sanitary facilities, dwellings, or buildings because of the flooding and poor site locations.

Constructing roads on suitable, well compacted fill above flood level and providing adequate side ditches and culverts or bridges help to prevent flood damage. The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength.

This soil is in capability unit VIw-7 dryland, Silty Overflow range site, and windbreak suitability group 10.

Hg—Holder silt loam, 0 to 1 percent slopes. This nearly level soil is on broad upland divides. It is deep and well drained. This soil formed in loess. The areas range from 10 to 800 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 19 inches thick. The upper part of the subsoil is grayish brown, friable silty clay loam; the middle part is brown, friable silty clay loam; and the lower part is pale brown, friable silt loam. The underlying material is very pale brown silt loam to a depth of 60 inches or more and is calcareous in the lower part. In places, the total thickness of the dark surface and subsurface layers is more than 20 inches.

Included with this soil in mapping are small areas of Butler, Crete, and Fillmore soils. Those soils have more clay in the subsoil and are in positions below the Holder soil. Fillmore soils are subject to ponding. The included soils make up 10 to 15 percent of this map unit.

Permeability is moderate, and available water capacity is high. Runoff is slow. Organic matter content is moderate, and natural fertility is high. Tilth is generally good, and the soil is easily tilled within a fairly wide range of moisture content. The water intake rate is moderately low.

Most of the acreage of this soil is cultivated. Some small areas are in native grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, and small grains. Grasses and alfalfa can be grown for hay and pasture. The primary concerns in management are maintaining fertility, conserving moisture, and reducing wind erosion. Small grains and the first cutting of alfalfa generally produce well because they grow and mature in spring when rainfall is highest. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, permits planting of crops without excessive cultivation or loss of soil moisture. Keeping crop residue on the surface also helps to maintain the content of organic matter, improves fertility, and reduces erosion.

This soil is suited to irrigated corn, grain sorghum, soybeans, and alfalfa. Both gravity and sprinkler systems are suitable. Most areas need leveling and a tailwater recovery system for efficient gravity irrigation. Production can be sustained by applying fertilizer, maintaining a high plant population, and using an efficient irrigation system. Keeping crop residue on the surface prevents excessive loss of soil moisture and reduces erosion.

This soil is suited to range. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in water erosion. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival and growth of adapted species are good. Limited rainfall is the main problem. Irrigation may be needed until seedlings are established or during prolonged droughts. Grasses and weeds compete with seedlings for moisture. Good site preparation and timely cultivation between the rows reduce this competition for moisture. Hoeing by hand, rototilling, or using carefully selected herbicides controls weeds and grasses within the rows.

This soil is generally suitable for septic tank absorption fields. Sewage lagoons need to be lined or sealed to prevent seepage. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units I-1 dryland and I-4 irrigated, Silty range site, and windbreak suitability group 3.

HgB—Holder silt loam, 1 to 3 percent slopes. This very gently sloping soil is on convex upland divides. This soil is deep and well drained. It formed in loess. The areas range form 10 to 500 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, very friable silt loam about 7 inches thick. The subsoil is friable and is about 18 inches thick. It is grayish brown silty clay loam in the upper part and pale brown silt loam in the lower part. The underlying material is very pale brown silt loam to a depth of 60 inches or more and is calcareous in the lower part. In places, the total thickness of the dark surface and subsurface layers is more than 20 inches. In other places, the soil has been graded for irrigation and the dark layers are as little as 7 inches thick.

Included with this soil in mapping are small areas of Butler, Crete, and Fillmore soils. Those soils have more clay in the subsoil and are in positions below the Holder soil. Butler and Fillmore soils are subject to ponding. The included soils make up about 10 to 15 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is medium. Organic matter content is moderate, and natural fertility is high. Tilth is generally good, and the soil is easily tilled within a fairly wide range of moisture content. The water intake rate is moderately low.

Most of the acreage of this soil is cultivated. Some small areas are in native grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, small grains, and alfalfa. Grasses and alfalfa can be grown for hay or pasture. The main problem is water

erosion. Water erosion can be controlled by terraces, grassed waterways, and contour farming. Grain sorghum can withstand longer periods of drought than most crops. Conservation tillage, which keeps crop residue on the surface as in no-till planting and stubble mulching, helps to prevent water erosion and loss of soil moisture. Keeping crop residue on the surface also helps to maintain the content of organic matter and improves fertility, tilth, and water intake.

This soil is suited to irrigated corn, grain sorghum, soybeans, and alfalfa. Both gravity and sprinkler systems are suitable. Most areas need leveling and a tailwater recovery system for efficient gravity irrigation. Enough irrigation water should be applied to meet the needs of the crops, but it should be applied at a rate that permits the soil to absorb as much of the water as possible with the least runoff. Keeping crop residue on the surface prevents excessive loss of soil moisture, improves tilth and water intake, and reduces erosion.

This soil is suited to range. A permanent grass cover controls wind and water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in water erosion. Deferment of grazing or haying helps to maintain or improve range condition.

This soil provides good sites for windbreaks. Survival and growth of adapted species are good. Limited rainfall is the main problem. If competing vegetation is controlled or removed by good site preparation and timely cultivation, the seedlings generally survive. Using appropriate herbicides and rototilling control undesirable grasses and weeds within the rows.

This soil is generally suitable for septic tank absorption fields. Sewage lagoons need to be lined or sealed to prevent seepage, and grading may be required to modify the slope and shape the lagoon. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIe-1 dryland and IIe-4 irrigated, Silty range site, and windbreak suitability group 3.

HgC—Holder silt loam, 3 to 6 percent slopes. This gently sloping soil is on broad ridges or on side slopes of drainageways in uplands. This soil is deep and well drained. It formed in loess. The areas range from 5 to 150 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, less friable silt loam about 7 inches thick. The subsoil is about 19 inches thick. It is brown, firm silty clay loam in the upper part; pale brown, firm silty clay loam in the middle part; and pale brown, friable silt loam in the lower part. The underlying material is very pale brown silt loam to a depth of 60 inches or more. The lower part of the underlying material is calcareous. The depth to calcium carbonates is less than 40 inches in a few places.

Included with this soil in mapping are small areas of Hobbs soils in drainageways in lower positions. Hobbs soils are stratified, contain less clay than the Holder soil, and are occasionally flooded. The included soils make up about 10 to 15 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is medium. Natural fertility is high, and organic matter content is moderate. Tilth is good. The water intake rate is moderately low.

Most of the acreage of this soil is cultivated. Most cropland is dryfarmed, though a few areas are irrigated. Some areas are in native grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, and small grains. Grasses and alfalfa can be grown for hay and pasture. The hazard of water erosion is the principal limitation. Runoff and water erosion can be controlled by terraces, grassed waterways, and contour farming. A cropping system that keeps the soil covered with crops or crop residue also reduces runoff and conserves moisture.

This soil is suited to irrigated corn, grain sorghum, alfalfa, and introduced grasses. Close-growing crops are more suitable than row crops. The principal hazards are water and wind erosion. This soil is suited to sprinkler systems. Maintaining fertility and properly distributing water are the important concerns in management. The rate at which water is applied should match the intake rate of the soil. Terraces, contour irrigation, grassed waterways, and crop residue kept on the surface reduce erosion.

This soil is suited to range. A permanent plant cover controls wind and water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival of adapted species is good and growth is fair if competing vegetation is controlled. Using appropriate herbicides and rototilling controls undesirable grasses and weeds within the rows. Contour planting and terraces reduce erosion and conserve moisture.

This soil is generally suitable for septic tank absorption fields. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil. Small buildings can be designed to fit the slope, or the soil can be graded to an acceptable slope.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIIe-1 dryland and IIIe-4 irrigated, Silty range site, and windbreak suitability group 3.

HgD—Holder silt loam, 6 to 11 percent slopes. This strongly sloping soil is on side slopes of uplands. It is deep and well drained. This soil formed in loess. The areas range from 10 to 40 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 8 inches thick. The subsoil is about 8 inches thick. It is grayish brown, friable silty clay loam in the upper part and brown, friable silt loam in the lower part. The underlying material is silt loam to a depth of 60 inches or more. It is pale brown in the upper part and very pale brown in the lower part. The underlying material is calcareous in the lower part.

Included with this soil in mapping are small areas of Geary, Hobbs, and Uly soils. Those soils are in lower positions. Geary soils are redder in the subsoil and underlying material than the Holder soil. Hobbs soils are in narrow drainageways, are stratified, and are occasionally flooded. Uly soils contain less clay in the subsoil and have carbonates nearer the surface. The included soils make up about 3 to 8 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is rapid. Natural fertility is medium, and organic matter content is moderate. Tilth is good. The water intake rate is moderately low.

Nearly all of the acreage of this soil is in native grasses for grazing or hay.

This soil is suited to dryfarmed sorghum, small grains and alfalfa. The principal limitation is the hazard of water erosion. Runoff and water erosion can be controlled by terraces, grassed waterways, and contour farming. Conservation tillage, which leaves crop residue on the surface, controls erosion. Also effective is a cropping system that keeps the soil covered with crops or crop residue by limiting row crops and using mostly close-growing crops in the rotation. Grassed field borders help to control runoff and can be used as turn rows, roadways, and wildlife habitat.

Alfalfa and introduced grasses are suitable for irrigation. Row crops are not so well suited because water management is difficult and erosion is a severe hazard. Terraces, contour irrigation, grassed waterways, and a mulch of crop residue help to control water erosion. Sprinkler irrigation is the only method suitable. Erosion by the combination of rainfall and irrigation water is difficult to control. The rate at which water is applied should match the intake rate of the soil.

This soil is suited to range. A permanent plant cover controls wind and water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil is suited to trees and shrubs for windbreaks. Survival of adapted species is good and growth is fair if competing vegetation is controlled by rototilling or careful use of appropriate herbicides within the rows or by cultivating between the rows. Contour planting and terraces reduce water loss and erosion.

For proper functioning of septic tank absorption fields, the land should be reshaped and the lines laid on the contour. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Dwellings and small buildings can be designed to fit the slope, or the soil can be graded to an acceptable slope. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IVe-1 dryland and IVe-4 irrigated, Silty range site, and windbreak suitability group 3.

HhC2—Holder silty clay loam, 3 to 6 percent slopes, eroded. This gently sloping soil is on side slopes of intermittent drainageways in the uplands. It is deep and well drained. This soil formed in loess. The areas range from 10 to 100 acres in size.

Typically, the surface layer is pale brown, friable silty clay loam about 6 inches thick. The underlying material is light gray and very pale brown silt loam to a depth of 60 inches or more. The lower part of the underlying material is calcareous. Most of the original surface layer

has been removed by erosion, and tillage has mixed the rest with the upper part of the subsoil. Rills are common after heavy rains. In some areas, the depth to lime is less than 36 inches.

Included with this soil in mapping are small areas of Hobbs soils in narrow drainageways and Uly soils in lower positions. Hobbs and Uly soils contain less clay than the Holder soil. Hobbs soils are stratified and are occasionally flooded. Uly soils have carbonates nearer the surface. The included soils make up 12 to 20 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is rapid. Natural fertility is low, and organic matter content is moderately low. Tilth is only fair, and this soil can be tilled only within a narrow range in moisture content. The water intake rate is low.

Nearly all of the acreage of this soil is used for crops. Some areas have been seeded to introduced grasses and are used for grazing. A few areas of cropland are irrigated.

This soil is suited to dryfarmed corn, grain sorghum, and small grains. Grasses and alfalfa can also be grown for hay and pasture. In hot, dry summers, crops can be damaged by lack of moisture. The principal limitation is the hazard of water erosion. Runoff and water erosion can be controlled by terraces (fig. 7), grassed waterways, and contour farming. Conservation tillage, which leaves crop residue on the surface, reduces runoff and conserves moisture. Small gullies can be shaped and seeded to grass. Grassed field borders help to control runoff and can be used as turn rows, roadways, and wildlife habitat. This soil is deficient in both nitrogen and phosphorus. They can be supplied by commercial fertilizer and barnyard manure.

Figure 7.—Terraces reduce soil erosion on Holder silty clay loam, 3 to 6 percent slopes, eroded.

This soil is suited to irrigated corn, grain sorghum, alfalfa, and introduced grasses. This soil is suited to sprinkler systems. The principal hazards are water and wind erosion. Improving fertility and properly distributing the water are the important concerns in management. The rate at which water is applied should match the intake rate of the soil. Terraces, contour irrigation, grassed waterways, and crop residue kept on the surface reduce erosion. Nitrogen and phosphorus are both needed and can be supplied by commercial fertilizer and barnyard manure.

This soil is suited to range. A permanent plant cover controls wind and water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded areas.

This soil is suited to trees and shrubs for windbreaks, but care is needed to control erosion. Terraces and contour planting reduce erosion and conserve surface moisture. Survival of adapted species is good and growth is fair if competing vegetation is controlled by cultivating between the rows and by using appropriate herbicides and rototilling within the rows.

This soil is generally suitable for septic tank absorption fields. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil. Small buildings can be properly designed to fit the slope, or the soil can be graded to an acceptable slope.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIIe-8 dryland and IIIe-3 irrigated, Silty range site, and windbreak suitability group 3.

HhD2—Holder silty clay loam, 6 to 11 percent slopes, eroded. This strongly sloping soil is on side slopes of uplands. This soil is deep and well drained. It formed in loess. The areas range from 10 to 60 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 5 inches thick. The underlying material is very pale brown silt loam to a depth of 60 inches or more. The lower part of the underlying material is

calcareous. Over most of the area, the original darkened surface layer has been removed by erosion and the present surface layer is tilled subsoil material. In places, the underlying material is exposed at the surface. Rills are common after heavy rains. In some areas, the surface layer is darker and is more than 5 inches thick. In places, the depth to carbonates is 20 to 36 inches.

Included with this soil in mapping are small areas of Geary and Uly soils. Those soils are in lower positions. Geary soils are redder in the subsoil and underlying material than the Holder soil. Uly soils contain less clay in the subsoil and have carbonates nearer the surface. The included soils make up 5 to 10 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is rapid. Natural fertility is low, and organic matter content is moderately low. Tilth is poor. The surface layer can be tilled only within a narrow range in moisture content. The water intake rate is low.

Nearly all of the acreage of this soil is used for dryfarmed crops. A few areas have been seeded to grasses and are used for grazing.

This soil is suited to dryfarmed corn, grain sorghum, small grains, and alfalfa. In hot dry summers, crops can be damaged by lack of sufficient moisture. The principal limitation is the hazard of water erosion. Runoff and water erosion can be controlled by terraces, grassed waterways, and contour farming. Also effective are conservation tillage, which keeps the soil covered with crops or residue, and a cropping system that limits row crops and uses close-growing crops in the rotation. Small gullies can be shaped and seeded to grass. Grassed field borders help to control runoff and can be used as turn rows, roadways, and wildlife habitat.

Alfalfa and introduced grasses are suitable for irrigation. Row crops are very poorly suited because water management is more difficult and erosion is a severe hazard. Terraces, contour irrigation, grassed waterways, and a mulch of crop residue help to control water erosion. Only sprinkler systems are suitable. Erosion by the combination of rainfall and irrigation water is difficult to control unless crop residue is kept on the surface. The rate at which water is applied should match the intake rate of the soil.

This soil is suited to range. A permanent plant cover controls wind and water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded areas.

This soil is suited to trees and shrubs for windbreaks. Survival of adapted species is good and growth is fair if competing vegetation is controlled by rototilling or careful use of appropriate herbicides within the rows or by cultivating between the rows. Contour planting and terraces reduce water loss and erosion.

For proper functioning of septic tank absorption fields, the land should be reshaped and the lines laid on the contour. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify slope and shape the lagoon. Dwellings and small buildings can be designed to fit the slope, or the soil can be graded to an acceptable slope. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IVe-8 dryland and IVe-3 irrigated, Silty range site, and windbreak suitability group 3.

Hk—Holder silt loam, thick surface, 0 to 1 percent slopes. This nearly level soil is on uplands. It is deep and well drained. This soil formed in loess. The areas range from 10 to 300 acres in size.

Typically, the surface layer is gray, very friable silt loam about 6 inches thick. The subsurface layer is about 19 inches thick. It is dark grayish brown, very friable silt loam in the upper part and grayish brown, very friable silt loam in the lower part. The surface of this soil has been thickened with soil material. The subsoil is about 25 inches thick. The upper part of the subsoil is grayish brown, friable silt loam; the middle part is brown, firm silty clay loam; and the lower part is pale brown, friable silt loam. The underlying material is silt loam. The upper part is light yellowish brown and the lower part is very pale brown to a depth of 60 inches or more. The lower part of the underlying material is calcareous. In places, the dark upper part is not as thick.

Included with this soil in mapping are small areas of Butler soils and Ortello loamy substratum soils. Butler soils have more clay in the subsoil than the Holder soil, are somewhat poorly drained and subject to ponding, and are in slight depressions. Ortello loamy substratum soils have more sand in the surface layer, are not as dark or as deep as the Holder soil, have a buried silty soil, and are in slightly higher positions. The included soils make up about 8 to 15 percent of this map unit.

Permeability is moderate, and available water capacity is high. Runoff is slow. Organic matter content is moderate, and natural fertility is high. Tilth is generally good, and the soil can be easily tilled within a fairly wide range of moisture content. The water intake rate is moderately low.

Most of the acreage of this soil is cultivated. A few small areas are in native grasses and are used for grazing.

This soil is suited to dryfarmed corn, grain sorghum, and small grains. Grasses and alfalfa can be grown for hay and pasture. The principal concerns in management are maintaining an adequate supply of moisture and maintaining fertility. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, protects the surface from blowing and prevents excessive evaporation. Row crops can be alternated with small grains or with hay and pasture crops in the rotation to control diseases and insects.

This soil is suited to irrigated corn, grain sorghum, alfalfa, and soybeans using either sprinkler or gravity systems. Some land leveling and a tailwater recovery system are needed for gravity irrigation. Conservation tillage, which leaves all or part of the crop residue on the surface as in no-till planting, helps to control wind erosion and conserves soil moisture. Irrigation water should be applied to meet the needs of the crop, but it should be applied at a rate that permits the soil to absorb as much water as possible with the least runoff.

This soil is suited to range. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival and growth of adapted species is generally good. Weeds and grasses compete with trees for moisture. Good site preparation and timely cultivation between the tree rows conserve available moisture. Careful use of selected herbicides and rototilling control weeds and grasses within the rows.

This soil is generally suitable for septic tank absorption fields. Sewage lagoons need to be lined or sealed to prevent seepage. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units I-1 dryland and I-4 irrigated, Silty range site, and windbreak suitability group 3.

Hr—Hord silt loam, 0 to 1 percent slopes. This nearly level soil is on stream terraces. It is rarely flooded. This soil is deep and well drained. It formed in silty alluvium. The areas range from 5 to 500 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, very friable silt loam about 9 inches thick. The subsoil is very friable silt loam about 28 inches thick. It is grayish brown in the upper part and light brownish gray in the lower part. The underlying material is light brownish gray silt loam with thin strata of finer textured material to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Detroit and Hobbs soils. Detroit soils contain more clay throughout than the Hord soil and are in slightly lower positions. Hobbs soils are stratified, are occasionally flooded, and are in narrow drainageways. The included soils make up about 2 to 8 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is slow. Organic matter content is moderate, and natural fertility is high. Tilth is generally good, and this soil can be easily tilled within a fairly wide range of moisture content. The water intake rate is moderate.

Most of the acreage of this soil is used for irrigated crops. A few small areas are in native grasses, native woodland, or farmsteads.

This soil is suited to dryfarmed corn, grain sorghum, small grains, and soybeans. Grasses and alfalfa can be grown for hay or pasture. The principal concerns in management are maintaining an adequate supply of moisture and maintaining fertility. Conservation tilage, which leaves crop residue on the surface as in minimum tillage, no-till planting, and stubble mulching, reduces erosion and prevents excessive evaporation. Crop diseases and insects can be controlled by alternating row crops with small grains or with hay and pasture in the rotation.

This soil is suited to irrigated corn, grain sorghum, alfalfa, and soybeans using either sprinkler or gravity systems. Some land leveling and a tailwater recovery system are generally required for gravity irrigation. Crop residue should be left on the surface to reduce erosion. Irrigation water should be applied to meet the needs of the crop, but it should be applied at a rate that permits the soil to absorb as much water as possible with the least runoff.

This soil is suited to range. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in water erosion. Deferment of grazing or haying helps to maintain or improve the range condition. Proper stocking, rotation grazing, and using commercial fertilizer improve pasture of introduced grasses.

This soil provides good sites for windbreaks. Survival and growth of adapted species is generally good. Weeds and grasses compete with trees for moisture. Good site preparation and timely cultivation between the tree rows conserve available moisture. Careful use of selected

herbicides and rototilling control weeds and grasses within the rows.

The rare flooding restricts use of this soil for sanitary facilities and buildings. Sewage lagoons need to be diked as protection from flooding. Dwellings and buildings can be constructed on elevated, well compacted fill as protection against flooding. Sewage lagoons also need to be lined or sealed to prevent seepage.

The surface pavement and base material of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the base provides the needed strength.

This soil is in capability units I-1 dryland and I-6 irrigated, Silty Lowland range site, and windbreak suitability group 1.

HrB—Hord silt loam, 1 to 3 percent slopes. This very gently sloping soil is on foot slopes and in low convex areas on stream terraces. This soil is deep and well drained. It formed in silty alluvium. The areas range from 10 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsurface layer is grayish brown, very friable silt loam about 7 inches thick. The subsoil is grayish brown, friable silt loam about 15 inches thick. The underlying material is light brownish gray silt loam with thin strata of darker or lighter colored material; it extends to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Hobbs and Holder soils. Hobbs soils are stratified, are occasionally flooded, and are in narrow drainageways. Holder soils have more clay in the subsoil than the Hord soil, are not dark to as great a depth, and are in slightly higher positions. The included soils make up less than 10 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is medium. Natural fertility is high, and organic matter content is moderate. Tilth is good, and this soil can be tilled within a fairly wide range of moisture content. The shrink-swell potential is low. The water intake rate is moderate.

Most of the acreage of this soil is used for irrigated crops. A few areas are dryfarmed and a few are in native grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, small grains, and alfalfa. The principal limitation is the hazard of water erosion. The main concerns in management are maintaining an adequate supply of moisture, reducing wind erosion, and maintaining fertility. Terraces, grassed waterways, and contour farming help to control water erosion. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, reduces erosion and prevents loss of soil moisture.

This soil is suited to irrigated corn, grain sorghum, and soybeans. Grasses and alfalfa can be grown for hay or pasture. Sprinkler systems are the most suitable. Leaving crop residue on the surface reduces wind erosion. Row crops can be grown continuously if a high level of management is used and a high level of fertility is maintained. Irrigation water should be applied to meet the needs of the crop, but it should be applied at a rate that permits the soil to absorb as much water as possible with the least runoff.

This soil is suited to range. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in severe water erosion. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival of adapted species is good. Weeds and grasses compete with trees for moisture. Competing plants can be controlled by cultivating between the rows with a disc or cultivator. Using appropriate herbicides or rototilling controls weeds and grasses within the rows.

This soil is generally suitable for sanitary facilities and dwellings and small buildings. Sewage lagoons need to be lined or sealed to prevent seepage, and some grading may be required to modify the slope and shape the lagoon.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength.

This soil is in capability units IIe-1 dryland and IIe-6 irrigated, Silty Lowland range site, and windbreak suitability group 1.

HrC—Hord silt loam, 3 to 6 percent slopes. This gently sloping soil is on foot slopes or on side slopes of intermittent drainageways that transect stream terraces. This soil is deep and well drained. It formed in silty colluvium and alluvium. The areas are generally long and narrow and range from 5 to 40 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is grayish brown, very friable silt loam about 14 inches thick. The underlying material is very pale brown silt loam to a depth of 60 inches or more. In places, the surface layer is not as thick.

Included with this soil in mapping are small areas of Hobbs and Holder soils. Hobbs soils are stratified, are occasionally flooded, and are in narrow drainageways below the Hord soil. Holder soils have more clay in the subsoil, are not dark to as great a depth, and are in similar or higher positions. The included soils make up less than 7 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is medium. Organic matter content is moderate, and natural

fertility is high. The shrink-swell potential is low. The water intake rate is moderate.

Most of the acreage of this soil is used for dryfarmed crops. Only a few areas are irrigated. Some small areas are in native grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, and small grains. Introduced grasses and alfalfa can be grown for hay or pasture. Small grains and grain sorghum are the more dependable crops. The principal limitation is the hazard of water erosion. Small grains mature in spring when rainfall is the highest. Grain sorghum can withstand longer periods of low rainfall in midsummer. The primary concerns of management are maintaining fertility, conserving moisture, and reducing wind and water erosion. Conservation tillage, which leaves a large amount of crop residue on the surface, as in minimum tillage, no-till planting, and stubble mulching, reduces wind erosion, conserves moisture, and improves fertility. Terraces, grassed waterways, and contour farming also reduce the rate of runoff and the hazard of erosion.

This soil is suited to irrigated corn, grain sorghum, and alfalfa. Either sprinkler or gravity systems can be used, but this soil is best suited to sprinkler systems. Gravity irrigation can be used with contour furrows or bench leveling. The principal hazards are water and wind erosion. Maintaining fertility and properly distributing the water are the important concerns in management. Terraces, contour irrigation, grassed waterways, and crop residue kept on the surface reduce erosion. The rate at which water is applied should not exceed the water intake rate.

This soil is suited to range. A permanent plant cover controls wind and water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in water erosion. Deferment of grazing or haying helps to maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded areas.

This soil provides good sites for windbreaks. Survival of adapted species is good and growth is fair. The principal hazards are drought and water erosion. Contour planting and terraces reduce erosion and conserve moisture. Using appropriate herbicides and rototilling control undesirable grasses and weeds within the rows. Areas between the rows can be cultivated with conventional equipment such as a disc or harrow.

This soil is generally suitable for sanitary facilities and dwellings and small buildings. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Small buildings can be designed to fit the slope, or the soil can be graded to an acceptable slope.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength.

This soil is in capability units IIIe-1 dryland and IIIe-6 irrigated, Silty range site, and windbreak suitability group 3.

InB—Inavale loamy sand, 0 to 3 percent slopes. This deep, somewhat excessively drained, nearly level and very gently sloping, undulating soil is on bottom lands. This soil is rarely flooded. It is deep and somewhat excessively drained. This soil formed in sandy alluvium. The areas are generally long and narrow and range from 5 to 40 acres in size.

Typically, the surface layer is grayish brown, very friable loamy sand about 7 inches thick. The upper part of the underlying material is light brownish gray sand about 35 inches thick, and the lower part is light gray loamy sand to a depth of 60 inches or more. The lower part contains thin strata of finer textured sediment. In a few small areas, the surface layer is fine sandy loam or loamy fine sand.

Included with this soil in mapping are small areas of Alda, Fonner variant, and Platte soils. Alda and Platte soils are somewhat poorly drained and are in lower positions than the Inavale soil. Fonner variant soils are moderately well drained and are also in lower positions. The included soils make up 5 to 10 percent of this map unit.

Permeability is rapid, and available water capacity is low. This soil releases moisture readily to plants but tends to lose much of it to deep percolation. Runoff is slow. Natural fertility and organic matter content are low. The surface layer is loose and can be easily tilled within a wide range in moisture content. The water intake rate is very high.

Most of the acreage of this soil is in native grasses and is used for range. A few areas are cultivated.

This soil is poorly suited to dryfarmed corn, sorghum, small grains, introduced grasses, and alfalfa. Small grains and the first cutting of alfalfa are generally the most dependable crops, because they grow in spring when rainfall is highest. The main limitations are the hazard of wind erosion and droughtiness. Keeping a cover of crop residue on the soil most of the time reduces wind erosion, conserves moisture, and maintains fertility. Wind erosion can also be reduced by stripcropping, conservation tillage, grassed field borders, and narrow windbreaks.

This soil is very poorly suited to irrigated corn, alfalfa, small grains, grasses, and legumes. Only sprinkler systems are suitable. The principal hazard is wind erosion. Application of water must be light but frequent to avoid excessive leaching of plant nutrients and because the available water capacity is low. A large amount of crop residue on the surface, stripcropping, field windbreaks, and conservation tillage help to control wind erosion.

The use of this soil for range controls wind erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Growth and survival of adapted species are fair. Lack of adequate moisture is the main limitation, and wind erosion is the principal hazard. Wind erosion can be prevented by maintaining sod or other vegetation between the rows. Undesirable weeds and grasses, which compete with trees for moisture, can be controlled by careful use of appropriate herbicides. Irrigation provides supplemental moisture during periods of low rainfall. Cultivation generally should be restricted to the tree rows and a cover crop planted between the rows.

This soil is not suitable for septic tank absorption fields because of the possibility of contaminating the ground water. Sewage lagoons need to be sealed or lined to prevent seepage. The walls or sides of shallow excavations can be temporarily shored to prevent sloughing or caving. Dwellings and buildings can be constructed on elevated, well compacted fill as protection against flooding.

Constructing roads on suitable, well compacted fill above flood level and providing adequate side ditches and culverts help to prevent flood damage.

This soil is in capability units IVe-5 dryland and IIIe-11 irrigated, Sandy Lowland range site, and windbreak suitability group 5.

Ma—Massie silt loam, 0 to 1 percent slopes. This nearly level soil is in the lowest, wettest parts of depressions or basins on the uplands. Water is generally ponded during the growing season (fig. 8). This soil is deep and very poorly drained. It formed in loess and in material washed from adjacent areas. The areas of this soil are somewhat oblong or oval and range from 5 to 180 acres in size.

Typically, there is a layer of partially decayed leaves and stems on the surface. The surface layer of the mineral soil is dark gray, very friable silt loam about 3 inches thick. The subsurface layer is gray, friable silt loam about 1 inch thick. The subsoil is about 52 inches thick. The upper part of the subsoil is dark gray and dark grayish brown, very firm silty clay; the next part is grayish brown, very firm silty clay; and the lower part is grayish brown, firm silty clay loam. The underlying material is brown silt loam to a depth of 60 inches or more. In some areas, the surface layer is silty clay loam and there is no subsurface layer. In some places soil is thinner over the underlying material. The thin organic layer is lacking and ponding is of shorter durations, and therefore the soil is not as poorly drained.

Included with this soil in mapping are small areas of poorly drained Fillmore soils in slightly higher positions.

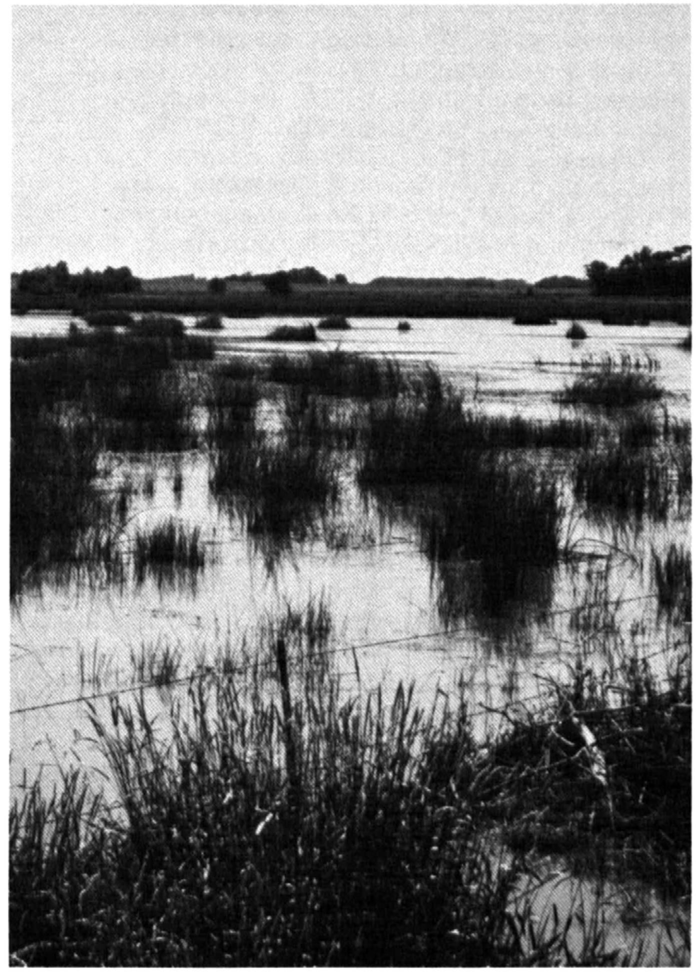

Figure 8.—Massie soils provide excellent habitat for waterfowl.

Fillmore soils have a thicker surface soil over the underlying material than the Massie soil, do not have the thin organic layer, have shorter periods of ponding, and are poorly drained. Areas of open water, which are devoid of vegetation, are also included. Inclusions make up less than 5 percent of this map unit.

Permeability is very slow. Available water capacity is high, but moisture is released to plants only slowly. This soil is ponded for very long periods from March through August. Organic matter content is high, and natural fertility is medium. The shrink-swell potential is high in the subsoil. This soil has a perched seasonal high water table. In wet years, the soil is covered with about 2 feet of water most of the time. In dry years, the water table is about 1 foot below the surface.

This soil supports wetland vegetation and is used principally for wildlife habitat.

This soil is unsuitable for dryland or irrigated farming, range, or windbreaks because it is ponded for very long periods.

This soil is suitable for wetland wildlife habitat. Potential is very poor for grain and seed crops, grasses and legumes, and wild herbaceous plants. Adjacent higher areas can provide these for wildlife food, shelter, and nesting. Potential for wetland plants is good. The vegetation includes sedges, rushes, cattails, perennial smartweed, arrowhead, pondweed, and reed canarygrass. Waterfowl such as geese and ducks are the primary users of this habitat. Openland wildlife, such as pheasants, occasionally use these areas for shelter in dry seasons when the ponded water is frozen in winter. Hunting is the main recreational use. Although potential for developing shallow water areas is good, low rainfall in summer and fall of some years can dry up the basins.

This soil is not suitable for septic tank absorption fields, sewage lagoons, shallow excavations, dwellings, or buildings because of the ponding. Other sites should be found.

Constructing roads on suitable, well compacted fill above the ponding and providing adequate side ditches and culverts help to prevent damage by ponded water. The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Damage to roads by frost action can be reduced by good surface drainage and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability unit VIIIw-8 and windbreak suitability group 10.

Or—Ortello fine sandy loam, 0 to 1 percent slopes. This nearly level soil is on stream terraces. This soil is deep and well drained. It formed in sandy and loamy sediment. The areas range from 10 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 7 inches thick. The subsoil is pale brown, very friable fine sandy loam about 28 inches thick. The underlying material is very pale brown sandy loam to a depth of 60 inches or more. In a few areas, the underlying material is sand below a depth of 40 inches. In some small areas in swales on lower parts of the landscape, the surface layer is loam.

Included with this soil in mapping are small areas of Cozad soils. Cozad soils have more clay in the subsoil than the Ortello soil, are stratified in the underlying material, and are rarely flooded. The included soils make up about 8 to 15 percent of this map unit.

Permeability is moderately rapid, and available water capacity is moderate. Runoff is slow. Organic matter content is moderately low, and natural fertility is medium. The surface layer is very friable and can be easily tilled within a fairly wide range of moisture content. The water intake rate is moderately high.

Most of the acreage of this soil is farmed. Many areas are irrigated. A small acreage is range.

This soil is suited to dryfarmed corn, grain sorghum, small grains, and alfalfa. The principal limitation is the hazard of soil blowing. Conservation tillage, which leaves crop residue on the surface as in stubble mulching or no-till planting, helps to prevent wind erosion and conserves moisture. Returning crop residue to the soil also helps to maintain and improve the organic matter content and fertility.

This soil is suited to irrigated corn, grain sorghum, and alfalfa. The principal hazard is soil blowing. This soil is suited to either gravity or sprinkler systems. The moderately high intake rate of this soil makes short runs and frequent irrigation desirable. Some land leveling and a tailwater recovery system are generally needed for gravity irrigation. Conservation tillage, which leaves crop residue on the surface as a mulch and minimizes tillage as in no-till planting, helps to control soil blowing.

The use of this soil for range controls erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. It also can cause severe soil blowing. Deferment of grazing or haying helps to maintain or improve the range condition.

For windbreaks, this soil is suited to trees and shrubs that tolerate a soil that is somewhat droughty. Survival and growth are fair. Wind erosion can be controlled by maintaining strips of sod or other cover between tree rows. Careful application of appropriate herbicides or rototilling controls weeds within the rows.

This soil readily absorbs the effluent from septic tank absorption fields but does not adequately filter the effluent, which can contaminate the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. This soil is generally suitable for building sites. The walls or sides of shallow excavations can be temporarily shored to prevent caving or sloughing.

Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIe-3 dryland and IIe-8 irrigated, Sandy range site, and windbreak suitability group 5.

OrB—Ortello fine sandy loam, 1 to 3 percent slopes. This very gently sloping soil is on stream terraces. This soil is deep and well drained. It formed in sandy and loamy sediment. The areas range from 15 to 150 acres in size.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 5 inches thick. The subsurface layer is dark grayish brown, very friable fine sandy loam about 5 inches thick. The subsoil is about 24 inches thick. It is grayish brown, very friable fine sandy loam in the upper part and pale brown sandy loam in the lower part. The underlying material is pale brown sandy loam to a depth of 60 inches. Some areas are more steeply sloping.

Included with this soil in mapping are small areas of Thurman soils, which are in slightly higher positions than the Ortello soils. Thurman soils contain more sand and are somewhat excessively drained. The included soils make up about 10 percent of this map unit.

Permeability is moderately rapid, and available water capacity is moderate. Runoff is slow. Organic matter content is moderately low, and natural fertility is medium. The surface layer is very friable and can be easily tilled within a fairly wide range of moisture content. The water intake rate is moderately high.

Most of the acreage of this soil is farmed. Some areas are irrigated. A small acreage is range.

This soil is suited to dryfarmed corn, grain sorghum, small grains, and alfalfa. The principal limitation is the hazard of soil blowing. Conservation tillage, which leaves crop residue on the surface as in stubble mulching or no-till planting, helps to prevent wind erosion and conserves moisture. Returning crop residue to the soil also helps to maintain and improve the organic matter content and fertility.

This soil is suited to irrigated corn, grain sorghum, soybeans, and alfalfa. The principal hazard is wind erosion. This soil is best suited to sprinkler systems. Conservation tillage, which leaves crop residue on the surface as a mulch, helps to control soil blowing.

The use of this soil for range controls soil blowing and water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can cause severe soil blowing. Deferment of grazing or haying helps to maintain or improve the range condition.

For windbreaks, this soil is suited to trees and shrubs that tolerate a soil that is somewhat droughty. Survival and growth are fair. Soil blowing can be controlled by maintaining strips of sod or other cover between tree rows. Careful application of appropriate herbicides, hoeing by hand, or rototilling controls weeds within the rows. Survival and growth can be increased by using supplemental irrigation methods, such as drip irrigation, during periods of insufficient rainfall.

This soil readily absorbs the effluent from septic tank absorption fields but does not adequately filter the effluent, which can contaminate the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. This soil is generally suitable for building sites. Walls and sides of shallow excavations can be temporarily shored to prevent sloughing or caving.

Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIIe-3 dryland and IIIe-8 irrigated, Sandy range site, and windbreak suitability group 5.

Ov—Ortello loam, loamy substratum, 0 to 1 percent slopes. This nearly level soil is on uplands. It is deep and well drained. This soil formed in sandy and loamy sediment. The areas range from 5 to 60 acres in size.

Typically, the surface layer is gray, very friable loam about 5 inches thick. The subsurface layer is about 17 inches thick. It is grayish brown, very friable loam in the upper part and grayish brown, very friable fine sandy loam in the lower part. The underlying material is grayish brown sandy loam to a depth of 38 inches. Beneath this is a buried silty soil. The buried layer is gray silt loam about 4 inches thick. Below this is pale brown silt loam about 8 inches thick. The underlying material is very pale brown silt loam to a depth of 60 inches. In some places, the buried soil is loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Holder thick surface soils, which contain more clay throughout the profile than the Ortello soil and are in slightly lower positions. The included soils make up 5 to 10 percent of this map unit.

Permeability is moderately rapid in the upper part of the profile and moderate in the lower silty part. Available water capacity is high, and moisture is released to plants readily. Runoff is slow. Organic matter content is moderately low, and natural fertility is medium. The surface layer is very friable and can be easily tilled within a wide range of moisture content. The water intake rate is moderate.

Most of the acreage of this soil is farmed. Many areas are irrigated. Only a small acreage is range.

This soil is suited to dryfarmed corn, sorghum, and small grains. Grasses and alfalfa can be grown for hay and pasture. This soil is better suited to dryfarmed crops than some Ortello soils because the silty buried soil holds more water within the root zone for use by plants. The principal concerns in management are maintaining fertility and organic matter content. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, reduces wind erosion and conserves soil moisture.

This soil is suited to irrigated corn, sorghum, soybeans, and alfalfa. Both sprinkler and gravity systems are suitable. Generally, some land leveling and a tailwater recovery system are needed for gravity irrigation. A mulch of crop residue on the surface, minimum tillage, and field windbreaks help to control soil blowing.

The use of this soil for range controls soil blowing effectively. Overgrazing, haying at the wrong time, and cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate and can also cause soil blowing. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil is suited to trees and shrubs for windbreaks. Seedling mortality generally is slight. Soil blowing can be controlled by maintaining strips of sod or a cover crop between the tree rows. Weeds and grasses can be controlled by cultivating between the rows and by careful use of appropriate herbicides within the rows.

The moderate permeability of this soil limits functioning of septic tank absorption fields, but this problem can generally be overcome by increasing the size of the field. This soil is suitable for dwellings and small buildings. Sewage lagoons need to be lined or sealed to prevent seepage.

Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units I-1 dryland and I-6 irrigated, Silty range site, and windbreak suitability group 3.

OvB—Ortello loam, loamy substratum, 1 to 3 percent slopes. This very gently sloping soil is on uplands. It is deep and well drained. This soil formed in sandy and loamy sediment. The areas are generally long and narrow in shape and range from 10 to 100 acres in size.

Typically, the surface layer is gray, very friable loam about 5 inches thick. The subsurface layer is dark gray, friable loam about 13 inches thick. The underlying material is gray fine sandy loam to a depth of 32 inches. Beneath this is a buried silty soil. The upper part is dark gray silt loam about 10 inches thick. Below this is light brownish gray silt loam about 8 inches thick. The underlying material is pale brown silt loam to a depth of 60 inches. In some areas, the subsoil has thin strata of coarser textured material. Some areas are more steep.

Included with this soil in mapping are small areas of Holder thick surface soils, which contain more clay throughout the profile than the Ortello soil and are in slightly lower positions. Also included are small areas of silty Uly soils. Uly soils do not have a buried soil below a depth of 20 inches and have less sand in the upper part of the profile. The included soils make up 5 to 10 percent of the map unit.

Permeability is moderately rapid in the upper part of the profile and moderate in the silty lower part. Available water capacity is high, and moisture is released to plants readily. Runoff is slow. Organic matter content is moderately low, and natural fertility is medium. The surface layer is very friable and can be easily tilled within a wide range in moisture content. The water intake rate is moderate.

Most of the acreage of this soil is farmed. Many areas are irrigated. Only a small acreage is range.

This soil is suited to dryfarmed corn, sorghum, and small grains. Grasses and alfalfa can be grown for hay and pasture. This soil is better suited to dryfarmed crops than some Ortello soils because the silty substratum holds more water within the root zone for use by plants. The principal concerns in management are water erosion, soil blowing and maintaining fertility and organic matter content. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, reduces water erosion and soil blowing and conserves soil moisture.

This soil is suited to irrigated corn, sorghum, soybeans, and alfalfa. Sprinkler systems are most suitable. Leaving a mulch of crop residue on the surface, keeping tillage to a minimum, and planting field windbreaks help to control soil blowing.

The use of this soil for range controls wind erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in wind erosion. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil is suited to trees and shrubs for windbreaks. Seedling mortality generally is slight. Soil blowing can be controlled by maintaining strips of sod or a cover crop between the tree rows. Weeds and grasses can be controlled by cultivating between the rows and by careful use of appropriate herbicides within the rows.

The moderate permeability of this soil limits functioning of septic tank absorption fields, but this problem can generally be overcome by increasing the size of the field. This soil is generally suitable for dwellings and small buildings. Sewage lagoons generally need to be sealed or lined to prevent seepage.

Damage to roads by frost action can be reduced by good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIe-1 dryland and IIe-6 irrigated, Silty range site, and windbreak suitability group 3.

Pb—Pits and Dumps. These miscellaneous areas are on bottom lands. They consist mainly of mounds of sand and overburden and the adjacent pits. Sand and gravel are stockpiled for use in construction. The pits contain water. Also included is an area of pumping equipment, roads, and loading docks. Flooding is rare over most of the area. The areas range from 5 to 80 acres in size.

Typical material in this map unit consists of a mixture of fine sand, medium sand, and coarse sand. There is no development of a soil profile.

Included in mapping are small areas of somewhat poorly drained Platte and Alda soils and areas of shallow Gothenburg soils. Those soils are in lower positions. The included soils make up 3 to 8 percent of the map unit.

Permeability of the material is rapid or very rapid. Available water capacity is very low, and runoff is very slow. Organic matter content is very low, and natural fertility is low. The level of the water in the pits generally is 2 to 8 feet below the land surface.

Most of the acreage of this unit is used for commercial mining of sand and gravel. A few areas have cottages. The water-filled pits are used for recreation and as wetland wildlife habitat.

Areas of this map unit are generally not suited to farming, range, windbreaks, or other agricultural pursuits. The mounds of sand are generally devoid of vegetation. In areas that are no longer actively mined, the vegetation gradually reestablishes itself.

Cottonwoods, willows, and pine can be planted by hand in either individual or scattered plantings. The trees need special care after planting to survive. They need protection from blowing sand, either by a native cover or by a wooden barrier. Newly planted trees may need supplemental watering to keep them alive. Establishing grass, shrubs, and trees around summer cottages is generally difficult.

This unit is suitable for the development of recreational areas. Roads can be built for access to lakes and picnic areas. In places, the fine sand makes ideal beaches. Areas can be developed for swimming by grading part of the sand back into the pits to reduce the depth of the water. Some of the pits are 35 to 55 feet deep.

Contamination of the ground water is possible with all types of sanitary facilities. Septic tank absorption fields are not suitable because of wetness and flooding. Sewage lagoons are not suitable because of flooding, rapid seepage, and wetness. Other sites should be found. In some areas, summer cottages have been built around the shoreline of the pits. There is a risk of flooding. Buildings should be constructed on the highest parts of this map unit. In shallow excavations, shoring or other special care is needed to prevent caving of the loose sand.

This soil is in capability unit VIIIs-8 and windbreak suitability group 10.

Pt—Platte loam, 0 to 1 percent slopes. This nearly level soil is on bottom lands. It is commonly in shallow, nearly flat abandoned stream channels but is also in slightly higher areas above the channels. This soil is occasionally flooded. It is somewhat poorly drained and is shallow over fine sand or gravelly sand. This soil formed in alluvium. The areas are generally elongated in shape and range from 10 to 300 acres in size.

Typically, the surface layer is dark gray, very friable, calcareous loam about 7 inches thick. The next layer is light gray, friable, calcareous fine sandy loam about 5 inches thick. The upper 4 inches of the underlying material is very pale brown, mottled fine sand, and the lower part is very pale brown gravelly sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of somewhat poorly drained Alda soils in slightly higher positions. Alda soils are coarser sand or gravelly sand below a depth of 20 to 40 inches and have more clay throughout. The included soils make up 10 to 15 percent of this map unit.

Permeability is moderate in the upper part and very rapid in the lower part. Available water capacity is low. Runoff is slow. Natural fertility is low, and organic matter content is moderately low. Tilth is good. Root development is restricted almost entirely to the layers above the fine sand or gravelly sand. The seasonal high water table is at a depth of about 1 foot in most wet years and about 2 feet in most dry years.

Most of the acreage of this soil is in native grasses and is used for hay and range. A few areas are cultivated, and most of these are irrigated.

This soil is poorly suited to dryfarmed grain sorghum, close-growing crops, and grasses. The main problems are wetness from the water table and flooding. Tillage is generally delayed in early spring. The fluctuating water table provides supplemental water for crops in spring, but this soil tends to be droughty in late summer when the water table is lowest. Conservation tillage of row crops, such as no-till planting, helps to prevent wind erosion and conserves moisture.

This soil is poorly suited to irrigated corn, grain sorghum, and introduced grasses. Sprinkler systems are most suitable. Land leveling is generally needed for gravity irrigation, but deep cuts should be avoided to prevent exposing the coarse material. Because of the very rapid permeability of the underlying material and the low available water capacity of this soil, applications of irrigation water and fertilizer must be light but frequent. In most years, tillage is delayed in spring by wetness from the high water table. Conservation tillage, which keeps crop residue on the surface, helps to maintain the organic matter content of the soil and reduces wind erosion in winter.

This soil is suited to range. Grazing when the soil is wet, however, causes surface compaction and poor tilth. Overgrazing, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deterioriate. Deferring grazing or haying and restricting use during very wet periods prevents overgrazing and helps to maintain good range condition.

This soil is suited to windbreaks. Trees and shrubs that tolerate the spring wetness should be used. Establishing the trees and cultivating can be difficult in wet years. Weeds and grasses can be controlled by

cultivating between the rows, rototilling within the rows, and hoeing by hand near the trees.

This soil is not suited to septic tank absorption fields or buildings because of the flooding and wetness. Other sites should be found. Sewage lagoons must be constructed on fill to raise the bottom of the lagoon above the seasonal high water table. Lagoons also need to be diked as protection from flooding, and they need to be lined or sealed to prevent seepage.

Constructing roads on suitable, well compacted fill above the flood level and providing adequate side ditches and culverts help to prevent flood damage and wetness. Damage to roads by frost action can be reduced by good surface drainage and a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IVw-4 dryland and IVw-13 irrigated, Subirrigated range site, and windbreak suitability group 2S.

Ru—Rusco silt loam, 0 to 1 percent slopes. This nearly level soil is in bottoms of swales and depressions on uplands. These areas are rarely flooded. This soil is deep and moderately well drained. It formed in recent loess and alluvium. The areas range from 5 to 40 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 7 inches thick. The subsurface layer is dark gray, friable silt loam about 7 inches thick. The subsoil is about 14 inches thick. It is grayish brown, friable silty clay loam in the upper part and pale brown, friable, mottled silt loam in the lower part. The underlying material is silt loam to a depth of 60 inches or more. The upper part is light gray and the lower part is pale yellow with mottles. In places the thickness of the surface layer has been altered by land leveling.

Included with this soil in mapping are small areas of Butler soils in basins lower than the Rusco soil and Uly soils in slightly higher positions. Butler soils contain more clay in the subsoil, and Uly soils have less clay. The included soils make up about 5 to 10 percent of this map unit.

Permeability is moderately slow, and available water capacity is high. Runoff is slow. Organic matter content is moderate, and natural fertility is medium. Tilth is generally good in the friable surface layer. The shrink-swell potential is moderate in the subsoil. The seasonal perched water table is at a depth of about 2 feet in most wet years and about 4 feet in most dry years. The water intake rate is moderately low.

Most of the acreage of this soil is used for irrigated crops. A few small areas are in native grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, small grains, and alfalfa. Wetness following heavy rains can delay tillage in spring of some years. Small grains and sorghum are more dependable than row crops because small grains mature in spring when rainfall is highest and grain sorghum can withstand longer periods when rainfall is low. The primary concerns in management are maintaining fertility, conserving moisture, and reducing wind erosion. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, reduces wind erosion and prevents evaporation. Returning crop residue to the soil also helps to maintain and improve tilth, fertility, and water intake.

This soil is suited to irrigated corn, grain sorghum, soybeans, and alfalfa. Both gravity and sprinkler systems are suitable. Land leveling and a tailwater recovery system improve surface drainage and increase efficiency of gravity irrigation systems. In some years, tillage is delayed in spring by excessive wetness. Irrigation water should be applied to meet the needs of the crop, but it should be applied at a rate that permits the soil to absorb as much water as possible with the least runoff. Conservation tillage, which leaves crop residue on the surface, improves tilth and water intake.

This soil is suited to range. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing when the soil is wet can cause surface compaction, which reduces water intake. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival and growth are good if the species selected tolerate occasional wetness. Seedlings generally survive and grow well if competing vegetation is controlled or removed by good site preparation, timely cultivation between the rows, and careful use of appropriate herbicides or rototilling within the rows.

The rare flooding and the wetness restrict use of this soil for sanitary facilities and buildings. Septic tank absorption fields can be constructed in fill above the seasonal high water table. Sewage lagoons need to be diked as protection from flooding.

Damage to roads by frost action can be reduced by good surface drainage and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIw-3 dryland and I-4 irrigated, Silty Lowland range site, and windbreak suitability group 1.

Sc—Scott silt loam, 0 to 1 percent slopes. This nearly level claypan soil is on bottoms of depressions in the uplands. This soil is frequently ponded for several months after heavy rains. This soil is deep and poorly drained. It formed in loess. The areas are commonly irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is gray, friable silt loam about 5 inches thick. The subsurface layer is light gray, very friable silt loam about 2 inches thick. The subsoil is about 36 inches thick. The upper part is dark gray, very firm clay; the middle part is grayish brown, firm silty clay; and the lower part is light brownish gray, mottled, firm silty clay loam. The underlying material is pale brown, calcareous silt loam to a depth of 60 inches or more. In some places, the combined thickness of the surface and subsurface layers is greater and the soil is better drained. In places, a thin layer of organic material is on the surface and the soil is very poorly drained.

Included with this soil in mapping are small areas of Butler soils. Butler soils are better drained than the Scott soil and are in slightly higher positions within the depressions. Butler soils have a thicker surface layer and a less distinct subsurface layer and are somewhat poorly drained. The included soils make up less than 10 percent of the map unit.

Permeability is very slow. Available water capacity is high, but moisture is released to plants only slowly. Water is ponded, and water is lost mainly by evaporation. Organic matter content is moderate, and natural fertility is medium. Tilth is fair. The shrink-swell potential is low in the surface layer and high in the subsoil. The perched seasonal high water table is 6 inches above the surface to 1 foot below the surface, mainly from March through August. The water intake rate is low.

Nearly two-thirds of the acreage of this soil is used as habitat for wetland wildlife. The rest is cultivated, but crops generally grow poorly unless a high level of management is used.

This soil is poorly suited to dryfarmed crops. The principal limitation is ponding following heavy rains. There are no natural drainage outlets. Grain sorghum and wheat can be grown in dry years, but in most years crops are lost. This soil is difficult to work because tillage commonly mixes the surface layer with the upper part of the very firm, clayey subsoil. Wind erosion is a hazard in dry years unless the soil is protected by crop residue.

A few areas of this soil are irrigated. Irrigation is feasible only where the ponding has been corrected by land leveling to fill the basin, surface drainage if a suitable outlet is available, and use of diversions or other methods to intercept water from higher areas.

This soil is not suited to range or windbreaks. Annual grasses, sedges, and weeds such as smartweed are the common plants on this soil.

This soil is not suitable for septic tank absorption fields. Sewage lagoons need to be constructed on fill to raise the bottom of the lagoon above the perched seasonal high water table. Dwellings also need to be constructed on raised, well compacted fill above the perched high water table. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provide the needed strength. Constructing roads on suitable, well compacted fill above the ponding level and providing adequate side ditches and culverts help to prevent damage by ponding and wetness. Damage to roads by frost action can be reduced by good surface drainage and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability unit IVw-2 dryland and windbreak suitability group 10.

Sd—Scott silty clay loam, drained, 0 to 1 percent slopes. This nearly level claypan soil is in the lowest part of depressions on the uplands. This soil is occasionally ponded for short periods after heavy rains. This soil is deep and somewhat poorly drained. It formed in loess. Areas of this soil were originally poorly drained or very poorly drained basins or depressions. Tile systems provide surface drainage and permit more frequent tillage. The areas of this soil are roughly oval or circular and range from 20 to 160 acres in size.

Typically, the surface layer is dark gray, firm silty clay loam about 4 inches thick. The subsoil is dark gray, very firm silty clay in the upper part; gray, very firm silty clay in the middle part; and grayish brown, firm silty clay loam in the lower part. The subsoil is about 42 inches thick. The underlying material is pale brown silty clay loam to a depth of 60 inches. Commonly, the surface and subsurface layers have been mixed with the upper part of the subsoil. In some places, the combined thickness of the surface and subsurface layers is greater and the soil is somewhat poorly drained.

Included with this soil in mapping are small areas of Butler soils in slightly higher parts of the depressions or basins. Butler soils have a thicker surface layer and a less distinct subsurface layer than the Scott soil and are somewhat poorly drained. The included soils make up 3 to 8 percent of this map unit.

Permeability is very slow. Available water capacity is high, but moisture is released to plants only slowly. Runoff is very slow, and water is ponded for several days after rains. Organic matter content is moderate, and natural fertility is medium. Tilth is poor. The surface layer is sticky when wet and very hard when dry. This soil can be tilled only within a narrow range of moisture content. The shrink-swell potential is low in the surface layer and high in the subsoil. The perched seasonal high water table is between the surface and a depth of about 2 feet for brief periods, mainly from March through August. The water intake rate is very low.

Nearly all of the acreage of this soil is used for crops or introduced grasses. Some areas have been seeded to

reed canarygrass, which is well suited to wet soil conditions.

This soil is poorly suited to dryfarmed crops. Crops grow poorly unless a high level of management is practiced. The principal limitation is ponding and wetness following heavy rains. Tile drains do not remove the ponded water fast enough to keep it from damaging growing crops. In dry seasons, grain sorghum and wheat can be grown. This soil is difficult to work because of the moderately fine textured surface layer and the excessive wetness. The principal management concerns are the difficulty of tillage, maintaining an adequate supply of moisture, and maintaining fertility. Conservation tillage, which leaves crop residue on the surface as in rototillage, improves tilth, reduces compaction, conserves moisture, and improves water intake. Shallow V-shaped ditches help to remove the excess surface water. Wind erosion is a hazard in dry years unless the soil is protected by crop residue.

Only a few areas of this soil are irrigated.

This soil can be used for range but seldom is. When the soil is wet, overgrazing causes surface compaction and forms small mounds, making grazing or hay cutting difficult. Deferring grazing and restricting use during very wet periods help to maintain or improve the range condition.

This soil is generally poorly suited to trees or shrubs for windbreaks because of the ponding. Only species that tolerate occasional wetness should be used. Weeds and grasses can be controlled by cultivating between tree rows with conventional equipment, using appropriate herbicides, and hoeing by hand or rototilling near the trees.

This soil is generally not suitable for septic tank absorption fields because of the wetness and slow permeability. Other sites should be found. Sewage lagoons must be constructed on fill to raise the bottom of the lagoon above the perched seasonal high water table. Dwellings also need to be constructed on raised, well compacted fill above the perched high water table. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength. Constructing roads on suitable, well compacted fill above the ponding and providing adequate side ditches and culverts help to prevent damage by ponded water. Damage to roads by frost action can be reduced by good surface drainage and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. The base material for roads can be mixed with additives, such as hydrated lime, to reduce shrinking and swelling.

This soil is in capability units IIIw-2 dryland and IIIw-1 irrigated, Clayey Overflow range site, and windbreak suitability group 2W.

ThD—Thurman fine sandy loam, 3 to 11 percent slopes. This gently sloping and strongly sloping soil is on valley sides between uplands and stream terraces or bottom lands. This soil is deep and somewhat excessively drained. It formed in loamy and sandy material. The areas range from 10 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 7 inches thick. The next layer is light brownish gray, very friable fine sandy loam about 8 inches thick. The underlying material is pale brown and very pale brown loamy fine sand to a depth of 60 inches or more. In some small areas, reddish brown silty material is at a depth of 40 to 60 inches. In places, the soil is fine sandy loam throughout. In some areas the profile contains more sand throughout.

Included with this soil in mapping are small areas of Coly and Geary soils, which are generally on side slopes along the drainageways and in lower positions. Coly and Geary soils contain more clay throughout the profile than the Thurman soil. Geary soils formed in redder material. The included soils make up 5 to 10 percent of this map unit.

Permeability is moderately rapid in the upper part and rapid in the underlying material. Available water capacity is moderate, and runoff is slow. Organic matter content is moderately low, and natural fertility is medium. Tilth is fair. The surface layer is very friable and can be tilled within a wide range of moisture content. The water intake rate is moderately high.

Most of the acreage of this soil is in native grasses and is used for range. A small acreage is cultivated.

This soil is poorly suited to dryfarmed crops. Grain sorghum, alfalfa, and wheat are the common crops grown. Alfalfa and small grains are more dependable because they grow and mature in spring and early summer when rainfall is highest. The principal limitations are the hazard of wind erosion and droughtiness in the latter part of the growing season. Conservation tillage, which leaves all or part of the crop residue on the surface as in no-till planting and stubble mulching, conserves soil moisture and controls wind erosion. Limiting row crops and using close-growing crops in the rotation also controls wind erosion.

This soil is poorly suited to irrigated corn, sorghum, and alfalfa. Only sprinkler systems are suitable. The principal hazard is wind erosion. Low fertility and proper distribution of irrigation water are the concerns in management. To avoid leaching of plant nutrients and because of the moderate available water capacity of this soil, applications of water should be light but frequent. A large amount of crop residue on the surface, stripcropping, field windbreaks, and minimum tillage help to control wind erosion.

Use of this soil for range controls wind erosion effectively. Overgrazing, haying at the wrong time, or cutting the grasses too short reduces the protective cover, causes the native vegetation to deteriorate, causes severe wind erosion, and creates blowouts. Deferment of grazing helps to keep the grasses healthy and vigorous.

This soil provides fair sites for windbreaks. Survival and growth of adapted species is fair. These soils are subject to blowing if disturbed. Seedlings can be planted in shallow furrows with as little disturbance of the soil as possible. Irrigation can provide supplemental water during periods of insufficient moisture. Seedlings can be damaged during high winds or covered by blowing sand.

Seepage from the septic tank absorption field can contaminate the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be temporarily shored to prevent sloughing or caving. Sites for dwellings need to be graded to an acceptable slope.

Cuts and fills are generally needed to provide a suitable grade for roads.

This soil is in capability units IVe-3 dryland and IVe-8 irrigated, Sandy range site, and windbreak suitability group 5.

ThF—Thurman fine sandy loam, 11 to 30 percent slopes. This steep soil is on uplands. It is deep and somewhat excessively drained. This soil formed in loamy and sandy material. The areas range from 15 to 500 acres in size.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 6 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 3 inches thick. The next layer is brown, very friable fine sandy loam about 7 inches thick. The underlying material is light yellowish brown loamy fine sand in the upper part and brownish yellow loamy fine sand in the lower part to a depth of 60 inches or more. In places, the underlying material is sandy loam to a depth of more than 40 inches. In places, the soil contains more sand.

Included with this soil in mapping are small areas of Coly and Geary soils. The Coly and Geary soils are steep and are on side slopes along drainageways and in higher positions. Coly and Geary soils are silty and contain more clay throughout the profile than the Thurman soil. Geary soils formed in redder material. Included soils make up 5 to 15 percent of this map unit.

Permeability is moderately rapid in the upper part and rapid in the underlying material. Available water capacity is moderate. Runoff is medium. Organic matter content is moderately low, and natural fertility is medium.

Most areas of this soil are range.

This soil is not suited to dryfarmed or irrigated crops because it is steep and droughty and is subject to wind and water erosion if disturbed. This soil is suited to grass and to wildlife habitat. Areas that have been cultivated can be returned to native vegetation.

The use of this soil for range controls erosion effectively. Overgrazing causes deterioration of desirable range plants. It can also cause severe erosion and create gullies. The desirable grasses can be kept healthy and vigorous with proper grazing, deferred grazing, and a planned grazing system.

This soil provides poor sites for windbreaks. Survival and growth of adapted species are poor. Steep slope and droughtiness generally limit the use of this soil for windbreaks.

This soil generally is not suitable for septic tank absorption fields because of the steep slopes. Other sites should be found. For sewage lagoons, extensive grading is required to modify the slope and shape the lagoon. Lagoons also need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be temporarily shored to prevent sloughing or caving. Dwellings can be designed to fit the slope, or the soil can be graded to an acceptable slope.

Cuts and fills are generally needed to provide a suitable grade for roads.

This soil is in capability unit VIe-3 dryland, Sandy range site, and windbreak suitability group 10.

Uy—Uly silt loam, 0 to 1 percent slopes. This nearly level soil is on uplands. This soil is deep and well drained. It formed in recent loess. The areas range from 10 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 7 inches thick. The subsoil is pale brown, very friable silty clay loam in the upper part and very pale brown, very friable, calcareous silt loam in the lower part. The subsoil is about 10 inches thick. The underlying material is very pale brown, calcareous silt loam to a depth of 60 inches or more. In some areas, the subsoil or underlying material is exposed over 30 to 40 percent of the surface as a result of land leveling for irrigation.

Included with this soil in mapping are small areas of Holder and Rusco soils. Holder soils have more clay in the subsoil than the Uly soil and have carbonates deeper in the profile. Rusco soils have more clay in the subsoil, are moderately well drained, and are in lower positions. The included soils make up about 5 to 10 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is slow. Organic matter content is moderate, and natural fertility is medium. Tilth is generally good, and this soil can be easily tilled within a fairly wide range of moisture content. The shrink-swell potential is low. The water intake rate is moderate.

Most of the acreage of this soil is used for irrigated crops. A few areas are dryfarmed, and a few small areas are in native grasses for grazing.

This soil is suited to dryfarmed grain sorghum, small grains, and alfalfa. The primary concerns in management are maintaining organic matter content and fertility, conserving moisture, and reducing wind erosion. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, reduces erosion and prevent loss of moisture by evaporation. Returning crop residue to the soil also helps to maintain and improve tilth and fertility.

This soil is suited to irrigated corn, grain sorghum, soybeans, and alfalfa. Both gravity and sprinkler systems are suitable. Land leveling and a tailwater recovery system are needed for gravity irrigation. Irrigation water should be applied to meet the needs of the crop, but it should be applied at a rate that permits the soil to absorb as much water as possible with the least runoff. Land leveling improves surface drainage and increases efficiency of gravity irrigation systems. Row crops can be grown continuously if a high level of management is used and fertility is maintained. Crop residue left on the surface reduces erosion and evaporation.

This soil is suited to range. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival and growth of adapted species is good. Weeds and grasses compete with trees for moisture. Undesirable plants can be controlled by cultivating between the rows with such conventional equipment as a disc or harrow and by using appropriate herbicides and rototilling within the rows.

This soil is generally suitable for sanitary facilities and dwellings and small buildings. Sewage lagoons need to be lined or sealed to prevent seepage.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength.

This soil is in capability units I-1 dryland and I-6 irrigated, Silty range site, and windbreak suitability group 3.

UyB—Uly silt loam, 1 to 3 percent slopes. This very gently sloping soil is on uplands. The areas in native grass are usually hummocky and lack well defined drainageways. This soil is deep and well drained. It formed in recent loess. The areas range from 5 to 80 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 5 inches thick. The subsurface layer is grayish brown, friable silt loam about 3 inches thick. The subsoil is brown silty clay loam in the upper part and pale brown silt loam in the lower part. The subsoil is about 11 inches thick. The underlying material is very pale brown, calcareous silt loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Holder and Ortello variant soils. Holder soils contain more clay in the subsoil than this Uly soil and have carbonates deeper in the profile. Ortello variant soils have more sand in the surface layer and have a buried silty soil. The included soils make up about 8 to 12 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is medium. Organic matter content is moderate, and natural fertility is medium. Tilth is generally good, and this soil can be easily tilled within a fairly wide range of moisture content. The shrink-swell potential is low. The water intake rate is moderate.

Most of the acreage of this soil is used for crops, both irrigated and dryfarmed. A few small areas are in native grasses for grazing.

This soil is suited to dryfarmed corn, grain sorghum, and small grains. Grasses and alfalfa can be grown for hay and pasture. The principal limitation is the hazard of water erosion. Water erosion can be controlled by terraces, grassed waterways, and contour farming. Grain sorghum, small grains, and alfalfa are generally the more dependable crops. The primary concerns of management are maintaining fertility, conserving moisture, and reducing erosion. Conservation tillage, which leaves crop residue on the surface as in no-till planting and stubble mulching, reduces water and wind erosion and conserves moisture. Returning crop residue to the soil also helps to maintain and improve tilth and fertility.

This soil is suited to irrigated corn, grain sorghum, soybeans, and alfalfa. Either gravity or sprinkler systems are suitable. Generally, some land leveling and a tailwater recovery system are needed for gravity irrigation. Irrigation water should be applied to meet the needs of the crop, but it should be applied at a rate that permits the soil to absorb as much water as possible with the least runoff. Row crops can be grown continuously if a high level of management is used and fertility is maintained. Keeping crop residue on the surface increases water intake and helps to prevent erosion.

This soil is suited to range. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil is well suited to trees and shrubs for windbreaks. Seedlings generally survive and grow well if competing grasses and weeds are controlled by timely cultivation between the rows and by careful use of selected herbicides or rototilling within the rows.

This soil is generally suitable for septic tank filter fields and sewage lagoons and for dwellings and small buildings. Sewage lagoons need to be lined or sealed to

prevent seepage, and some grading may be required to modify the slope and shape the lagoon.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or bases provides the needed strength.

This soil is in capability units IIe-1 dryland and IIe-6 irrigated, Silty range site, and windbreak suitability group 3.

UyC—Uly silt loam, 3 to 6 percent slopes. This gently sloping soil is on uplands. Typically, the areas are hummocky and are on sides of drainageways or on the slope breaks between the uplands and lower benches of the Platte River valley. This soil is deep and well drained. It formed in recent loess. The areas range from 15 to 100 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 7 inches thick. The subsoil is pale brown silt loam in the upper part and very pale brown silt loam in the lower part. The subsoil is about 11 inches thick. The underlying material is very pale brown, calcareous silt loam to a depth of 60 inches or more. In a few places, the surface layer is lighter colored than typical as a result of erosion.

Included with this soil in mapping are small areas of Ortello loamy substratum soils and Rusco and Thurman soils. Ortello loamy substratum soils have more sand in the surface layer than the Uly soil and have a buried silty soil. Rusco soils have more clay in the subsoil, are moderately well drained, and are in lower positions. Thurman soils have more sand throughout, are somewhat excessively drained, and are in lower positions. The included soils make up about 5 to 15 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is medium. Organic matter content is moderate, and natural fertility is medium. Tilth is generally good, and this soil can be easily tilled within a fairly wide range of moisture content. The shrink-swell potential is low. The water intake rate is moderate.

Most of the acreage of this soil is cultivated. Most areas of cropland are dryfarmed, though a few are irrigated. Some areas are in native grasses for grazing.

This soil is suited to dryfarmed grain sorghum and small grain. Grasses and alfalfa can also be grown for hay and pasture. The hazard of water erosion is the principal limitation. Drought is a problem during hot summer months when rainfall is below normal. Runoff and water erosion can be controlled by terraces, grassed waterways, and contour farming. Conservation tillage, which leaves crop residue on the surface as in minimum tillage, no-till planting, and stubble mulching, reduces runoff and conserves moisture.

This soil is suited to irrigated corn, grain sorghum, alfalfa, and introduced grasses. Close-growing crops are better suited than row crops. The principal hazards are water and wind erosion. This soil is better suited to sprinkler irrigation than to gravity systems. Maintaining fertility and properly distributing the water are important concerns in management. The rate at which water is applied should match the intake rate of the soil. Terraces, contour irrigation, grassed waterways, and crop residue kept on the surface reduce erosion.

This soil is suited to range. A permanent plant cover controls wind and water erosion effectively. Overgrazing by livestock, haying at the wrong time, or cutting the grasses too short reduces the protective cover and causes the native vegetation to deteriorate. Overgrazing also can result in water erosion. Deferment of grazing or haying helps to maintain or improve the range condition.

This soil provides good sites for windbreaks. Survival of adapted species is good and growth is fair. The principal hazards are drought and water erosion. Irrigation water may be needed during periods of low rainfall. Contour planting and terraces reduce erosion. Using selected herbicides and rototilling control undesirable grasses and weeds within the rows. Areas between the rows can be disked or harrowed.

This soil is generally suitable for septic tank filter fields and sewage lagoons and for dwellings and small buildings. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Buildings can be designed to fit the slope, or the soil can be graded to an acceptable slope.

The surface pavement and subbase of roads should be thick enough to compensate for the low strength of the soil material. Using coarse-grained material for the subgrade or base provides the needed strength.

This soil is in capability units IIIe-1 dryland and IIIe-6 irrigated, Silty range site, and windbreak suitability group 3.

UyE2—Uly silt loam, 11 to 17 percent slopes, eroded. This moderately steep soil is generally on short side slopes of intermittent drainageways in the uplands. This soil is deep and well drained. It formed in loess. The areas are commonly long and narrow and range from 10 to 50 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 4 inches thick. The underlying material is silt loam to a depth of 60 inches or more. It is pale brown in the upper part and very pale brown in the lower part. The lower part of the underlying material is calcareous. Over most of the area the original darkened surface layer has been removed by erosion and the remainder has been mixed with the upper part of the underlying material. However, erosion has not been uniform on this soil. Rills are common after rains. In some places, the upper part of the underlying material contains more clay than is typical and carbonates are deeper in the profile.

Included with this soil in mapping are small areas of Geary and Hobbs soils. The eroded Geary soils are in lower positions than the Uly soil. Geary soils have more clay in the subsoil and formed in redder material. Hobbs soils are stratified and are occasionally flooded. They are on the bottom lands of drainageways. The included soils make up about 5 to 10 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is rapid. Organic matter content and natural fertility are moderately low. Tilth is fair. The shrink-swell potential is low.

Nearly all of the acreage of this soil has been seeded to native grasses and is used for grazing. Some areas are cultivated.

This soil is not suited to cultivated crops, either dryfarmed or irrigated, because it is too steep and erodible. This soil should be seeded to native grasses and kept in permanent plant cover.

Use of this soil for range controls erosion effectively. Deferment of grazing or haying when areas are seeded to grasses helps to maintain and improve the range condition.

This soil is suited to trees and shrubs for windbreaks, but care is needed to control erosion. Survival and growth are only fair. Seedlings generally survive if competing vegetation is controlled or removed by good site preparation and timely cultivation.

Septic tank absorption fields can be installed on the contour after the site has been graded. Other sites must be found for sewage lagoons because an excessive amount of grading is usually necessary on this soil. Buildings can be designed to fit the slope or much cutting and filling is needed.

Roads must be designed to overcome the low strength of the soils.

This soil is in capability unit VIe-8 dryland, Silty range site, and windbreak suitability group 3.

UyF—Uly silt loam, 11 to 30 percent slopes. This steep soil is mainly on short sides of drainageways in the uplands. A few areas are on terrace breaks or on the sides of drainageways that cross the terraces. This soil is deep and somewhat excessively drained. It formed in loess. The areas are long and narrow and range from 5 to 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 10 inches thick. The subsoil is grayish brown, very friable silt loam about 7 inches thick. The underlying material is silt loam to a depth of 60 inches or more. It is light brownish gray in the upper part and light gray in the lower part. The lower part of the underlying material is calcareous. In some areas, the surface layer is less than 10 inches thick because of erosion caused by overgrazing or cultivation. In places, the subsoil contains more clay.

Included with this soil in mapping are small areas of Geary, Hobbs, and Holder soils. Geary soils are on short, steep side slopes below the Uly soil. Geary soils have more clay in the subsoil and formed in redder material. Hobbs soils are stratified and are occasionally flooded. They are on the narrow bottom lands of intermittent drainageways. Holder soils are on side slopes above the Uly soil. The included soils make up about 10 to 20 percent of this map unit.

Permeability is moderate. Available water capacity is high, and moisture is released to plants readily. Runoff is rapid. Organic matter content is moderately low, and natural fertility is medium. Tilth is good in this very friable soil. The shrink-swell potential is low.

Nearly all of the acreage of this soil is in native grasses for grazing and hay. A few small isolated areas are cultivated.

This soil is not suited to cultivated crops, either dryfarmed or irrigated, because it is too steep and erodible. A few small cultivated areas are severely eroded; these areas can be planted to native grasses for grazing. Dams for livestock water, erosion control structures, and flood retention reservoirs can be built in some of the drainageways.

Use of this soil for range controls erosion effectively. Overgrazing reduces the plant cover and causes severe water erosion. Deferment of grazing helps to maintain or improve the range condition.

This soil is too steep and erodible for windbreaks. In a few places trees can be planted by hand, but they need special tending.

Septic tank absorption fields and sewage lagoons are generally not constructed or suitable on this steep soil. Other sites or another method of disposal must be selected wherever possible. Sites for buildings, with or without basements, can be graded to modify the slope, the building can be designed to fit the slope, or another site can be found.

Cutting and filling is required to provide a suitable grade for roads. Roads must be designed to overcome the low strength of the soil.

This soil is in capability unit VIe-1 dryland, Silty range site, and windbreak suitability group 10.

Prime Farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in Hamilton County are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations or hazards are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland can be obtained at the local office of the Soil Conservation Service.

About 299,000 acres, or nearly 86 percent, of Hamilton County meets the soil requirements for prime farmland.

A recent trend in land use in some parts of the county has been the conversion of some prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are wet, more erodible, droughty, or difficult to cultivate and less productive than prime farmland.

Some soils qualify as prime farmland only if some limitation is overcome by appropriate measures. One prime farmland soil in Hamiton County—Butler silt loam—is naturally wet, but the soil generally has been adequately drained, either by the application of drainage measures or through incidental drainage that results from farming operations, road building, or other kinds of land development.

The following map units, or soils, make up prime farmland in Hamilton County. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Bu	Butler silt loam, 0 to 1 percent slopes (where drained)
Cw	Cozad silt loam, 0 to 1 percent slopes
CwB	Cozad silt loam, 1 to 3 percent slopes
Cx	Cozad silt loam, wet substratum, 0 to 1 percent slopes
Cy	Crete silt loam, 0 to 1 percent slopes
De	Detroit silt loam, 0 to 1 percent slopes
Dt	Detroit silt loam, terrace, 0 to 1 percent slopes
DtB	Detroit silt loam, terrace, 1 to 3 percent slopes
Fo	Fillmore silt loam, drained, 0 to 1 percent slopes
Hc	Hastings silt loam, 0 to 1 percent slopes
HcB	Hastings silt loam, 1 to 3 percent slopes
HdC2	Hastings silty clay loam, 3 to 6 percent slopes, eroded
He	Hobbs silt loam, 0 to 2 percent slopes
Hg	Holder silt loam, 0 to 1 percent slopes
HgB	Holder silt loam, 1 to 3 percent slopes
HgC	Holder silt loam, 3 to 6 percent slopes
HhC2	Holder silty clay loam, 3 to 6 percent slopes, eroded

Hk Holder silt loam, thick surface, 0 to 1 percent slopes
Hr Hord silt loam, 0 to 1 percent slopes
HrB Hord silt loam, 1 to 3 percent slopes
HrC Hord silt loam, 3 to 6 percent slopes
Or Ortello fine sandy loam, 0 to 1 percent slopes
OrB Ortello fine sandy loam, 1 to 3 percent slopes
Ov Ortello loam, loamy substratum, 0 to 1 percent slopes
OvB Ortello loam, loamy substratum, 1 to 3 percent slopes
Ru Rusco silt loam, 0 to 1 percent slopes
Uy Uly silt loam, 0 to 1 percent slopes
UyB Uly silt loam, 1 to 3 percent slopes
UyC Uly silt loam, 3 to 6 percent slopes

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland or windbreaks; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

By William E. Reinsch, conservation agronomist, Soil Conservation Service

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified, the system of land capability classification used by the Soil Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Information for planning management systems for individual fields or farms is given in the description of each soil under "Detailed Soil Map Units." Further information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Most of the farmland in Hamilton County is cultivated. In 1978, 89 percent of the acreage in farms was used for crops. The largest acreage is in corn, followed by sorghum, soybeans, wheat, and alfalfa hay. About 81 percent of the cropland is irrigated.

Most soils of Hamilton County are well suited to cultivated crops if they are well managed. The Hastings and Holder soils make up most of the acreage used for crops.

Dryland Management

Good management for dryfarming reduces runoff and erosion, conserves moisture, and improves tilth. Most of the soils in Hamilton County are suitable for the production of crops. In many areas, however, the erosion hazard needs to be reduced by suitable conservation practices.

Water erosion is a major problem on some of the soils that are suitable for crops. Loss of the surface layer to erosion is damaging for two reasons. First, productivity is reduced when the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging to soils that have a clayey subsoil, such as Geary and Hastings soils. Second, the sediment produced by erosion pollutes streams. Control of erosion minimizes sediment pollution and improves the quality of water for municipal and recreational uses and for fish and wildlife.

The overall hazard of erosion can be reduced if the more productive soils are used for row crops and the steeper, more erodible soils are used for close-growing crops, such as wheat, rye, alfalfa, hay, and pasture. Good management can reduce the hazard of erosion in many areas. Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping sequence that keeps a plant cover on the soil for extended periods reduces soil erosion so that the productive capacity of the soil is not decreased. At least

20 percent of the surface has to be left covered to reduce erosion significantly.

Terraces, contour farming, grassed waterways, contour stripcropping, and conservation tillage can be used in Hamilton County. No-till and till-plant systems for row crop production reduce erosion on sloping land. These conservation tillage practices can be adapted to most soils in the survey area. Terraces and diversions reduce the length of slope and reduce runoff and erosion; they are most effective on deep, well drained soils that have regular slopes. Holder and Hastings soils are suitable for terraces and contour farming. Contour farming also improves the effectiveness of conservation tillage.

The hazard of wind erosion on the Ortello and Thurman soils is greatest when they are used for row crops, but management practices similar to those that control water erosion can be used to control erosion by wind. Stubble mulching, conservation tillage, crop residue management, wind stripcropping, and narrow field windbreaks reduce wind erosion.

Cropland management should preserve tilth and fertility; maintain a plant cover that protects the soil from erosion; control weeds, insects, and diseases; and reduce runoff. Management systems vary according to the soils on which they are used. For example, a management system for crops on Holder silty clay loam, 6 to 11 percent slopes, eroded, should include a large proportion of grass and legume crops in the rotation, terraces, contour farming, and tillage that leaves a 40 percent cover of crop residue on the surface after planting. In contrast, on Hord silt loam, 0 to 1 percent slopes, row crops can be grown continuously. If crop residue is left on the field through winter, applications of fertilizer and good management are sufficient to maintain the productive capacity of this soil.

In intensive cropping systems, crop residue is an important asset to water conservation, maintenance of fertility, and erosion control. Standing crop stubble traps snow on the field and limits evaporation. Crop residue returned to the soil helps to maintain soil fertility and improves tilth for future crops. Two tons of crop residue per acre contains about 20 pounds of nitrogen, 10 pounds of available phosphate, and about 30 pounds of potash. Soil bulk density is reduced by returning crop stubble to the soil, and soil crusting and fuel requirements for tillage are reduced by lower soil density. More importantly, crop residue on the surface helps to control erosion.

On livestock farms, management includes growing grasses and legumes in the crop rotation and adding manure to improve fertility. These practices reduce water and wind erosion on short and irregular slopes where contouring and terracing are not feasible. In addition, they supply plant nutrients and improve tilth. Crop residue on the surface also reduces erosion.

Under dryland management, the kind and amount of fertilizer to be applied should be based on the results of soil tests and on the content of moisture in the soil at the time of application. If the subsoil is dry and rainfall is low, the rate at which fertilizer is applied should be slightly lower than the rate used if the subsoil moisture is adequate. For nonlegume crops, nitrogen is beneficial on all soils. Phosphorus and zinc are needed on the more eroded soils or in areas that were excavated for construction of terraces or waterways.

Herbicides control weeds, but care should be taken to apply the correct kind at the proper rate to correspond with soil conditions. The colloidal clay and humus in the soil are responsible for the greatest part of the chemical activity of the soil. Therefore, crop damage from herbicides can occur in sandy soils (low in colloidal clay) and in soils having moderately low to low organic matter content. The application rate of herbicides should be lowered on these soils.

Irrigation Management

About 81 percent of all cropland in Hamilton County is irrigated. Corn is grown on about 87 percent of the irrigated cropland. Soybeans and sorghum are also irrigated. Either furrow or sprinkler systems are suitable for corn, sorghum, and soybeans. Alfalfa can be irrigated by border, contour ditch, corrugation, or sprinkler systems. The irrigation water comes almost entirely from wells.

The cropping system on soils that are well suited to irrigation consists mostly of row crops. A cropping sequence that includes different row crops, small grains, and alfalfa or grass helps to control the cycles of disease and insects that are commonly present if the same crop is grown year after year.

Soil can hold only a limited amount of water. Irrigation water, therefore, is applied at regular intervals to keep the soil profile moist at all times. The interval varies according to the crop and the time of year. Silt loam and silty clay loam soils in Hamilton County hold about 2 inches of available water per foot of soil depth. A soil that is 4 feet deep and planted to a crop that sends its roots to that depth can hold about 8 inches of available water for that crop. Maximum efficiency of furrow irrigation is obtained if the irrigation process is started when about half of the stored water has been used by the plants. Thus, if a soil holds 8 inches of available water, irrigation should be started when 4 inches has been removed. Water should be applied only as fast as the soil can absorb it.

Irrigated soils generally produce higher yields than dryfarmed soils; consequently, more plant nutrients, particularly nitrogen and phosphorus, are removed in the harvested crops. Returning all crop residue to the soil and adding feedlot manure and commercial fertilizer help to maintain the fertility of the soil. Most grain crops in Hamilton County respond to nitrogen. If the soil has been disturbed for land leveling, and particularly if the

topsoil has been removed, crops also respond to phosphorus, zinc, and iron. The kinds and amounts of fertilizer needed for specific crops should be determined by soil tests.

Gently sloping soils, such as Holder silt loam, 3 to 6 percent slopes, are subject to water erosion if irrigation furrows run down the slope. If furrow irrigation is used, the gently sloping soils can be contour bench leveled, or the furrows can be laid on the contour in combination with parallel terraces. Land leveling increases the efficiency of irrigation because water can be distributed more evenly.

A tailwater recovery system at the end of the furrow-irrigated field traps runoff from excess irrigation (fig. 9). This water can then be pumped to the upper end of the field and applied again. Tailwater recovery increases the efficiency of the irrigation system and conserves water.

Sprinkler systems can be used on the more sloping soils as well as on the nearly level ones. If a sprinkler irrigation system is used on such soils as Hastings silty clay loam, 3 to 6 percent slopes, eroded, and Holder silty clay loam, 6 to 11 percent slopes, eroded, the same conservation practices that are used to control water erosion on nonirrigated cropland are needed. These practices include terraces, contour farming, grassed waterways, and tillage that leaves a protective cover of crop residue on the surface. These practices are important for conserving water and reducing erosion.

There are two general kinds of sprinkler system. Those that operate in sets are placed in a certain location and operate there until a specified amount of water has been applied. The center-pivot type (fig. 10) is an array of sprinklers that rotates around a central pivot point. In sprinkler systems, water is applied at a rate at which the soil can absorb it without runoff.

Because the application of water can be carefully controlled, sprinkler systems have special use in conservation, as in establishing new pastures on moderately steep slopes. In summer, however, much water is lost through evaporation. Wind drift can cause uneven application of water with some sprinkler systems. Watering at night, when wind and temperature are lower, reduces evaporation and improves distribution.

All of the soils in Nebraska are placed in irrigation design groups *(8)*. The Arabic number of the irrigated capability unit for each soil indicates the irrigation design group to which the soil belongs. Assistance in planning and designing irrigation systems is available from the local office of the Soil Conservation Service or the county agricultural agent. Estimates of the cost of equipment can be obtained from local dealers and manufacturers of irrigation equipment.

Pasture and Hay

Most forage plants are a good source of minerals, vitamins, proteins, and other nutrients for cattle and sheep. A well managed pasture can provide a balanced ration throughout the growing season. Once the pasture has been established, the grasses need to be kept productive. A planned grazing system that meets the needs of the plants and promotes uniform utilization of forage is important for best returns.

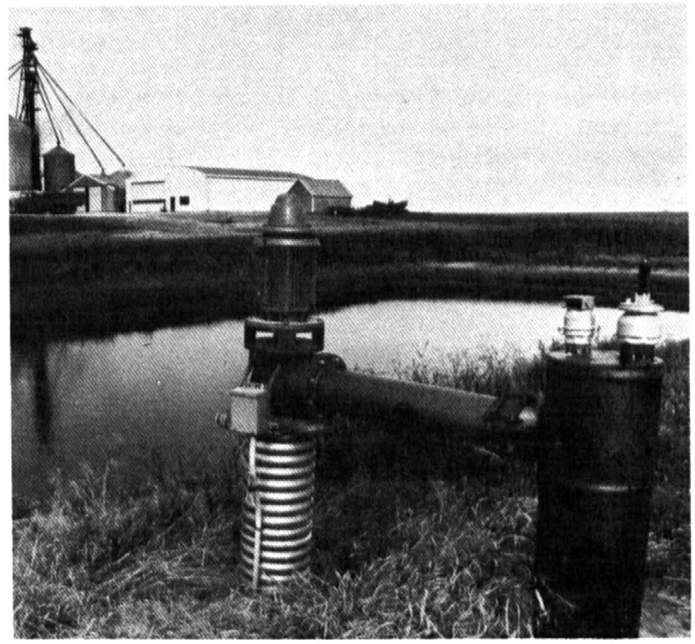

Figure 9.—Irrigation reuse systems reduce runoff and conserve irrigation water.

A mixture of grasses and legumes can be grown profitably on many kinds of soil. Grasses and legumes are compatible with grain crops in rotation, and they build up the soil. Because grasses and legumes improve tilth, add organic matter, and reduce erosion, they are ideal for use in a conservation cropping system.

Irrigated pasture in Hamilton County can produce 750 to 900 pounds of beef per acre under a high level of management. Cropland can be converted to irrigated pasture to control erosion. The most commonly grown grasses in irrigated pasture are smooth brome and orchardgrass. Other grasses and legumes that are suitable for irrigation in Hamilton County are intermediate wheatgrass, meadow brome, and creeping foxtail.

Grasses that can be grown without irrigation are smooth brome, intermediate wheatgrass, meadow brome, and tall fescue. Some native warm-season grasses can be planted as a single species on nonirrigated land to extend forage quality during the grazing season. Switchgrass, indiangrass, and big bluestem are suitable.

Legumes that can be used in irrigated or nonirrigated pasture are alfalfa, birdsfoot trefoil, and cicer milkvetch.

Figure 10.—Center-pivot irrigation on Hastings silt loam, 0 to 1 percent slopes.

Grasses and legumes grown for pasture and hay, irrigated or not, require additional plant nutrients to obtain maximum vigor and growth. The kinds and amounts of fertilizer needed should be determined by soil tests.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability

classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIs-2 or IIIe-1.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in table 5.

Rangeland

By Peter N. Jensen, range conservationist, Soil Conservation Service

The raising of livestock is the second largest agricultural industry in Hamilton County. Most livestock farms keep small cow and calf herds and sell the calves in fall as feeders. The average size of livestock farms is about 400 acres.

Range makes up approximately 7 percent of the agricultural land in the county. It is largely on strongly sloping, loamy and sandy uplands adjacent to the Platte River valley and on bottom lands of the Platte River where the soils have a high water table. The range is generally grazed from late spring through early fall. The livestock graze corn or grain sorghum aftermath in fall and early winter and are fed native or alfalfa hay or silage for the rest of the winter.

In some areas the range has been depleted by overuse. Approximately 35 percent of the rangeland is producing less than half of its potential native forage. The overused areas are supporting low-producing grasses and broadleaf weeds. The productivity of the range can be increased by sound management: proper grazing use, rest or deferment, and planned grazing systems. In addition, range seeding may be needed on cropland where soil loss exceeds tolerable limits.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. Explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Most of the range is in the Sandy and Silty range sites of the Thurman-Coly association and the Subirrigated

range site of the Gothenburg-Platte-Alda association. The rest of the soils are in the Clayey, Clayey Overflow, Silty Overflow, Silty Lowland, and Sandy Lowland range sites.

Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Production figures are the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Windbreaks and Environmental Plantings

By Keith A. Ticknor, forester, Soil Conservation Service

Most farmsteads in Hamilton County have trees around them. The trees were planted by the landowners at various times. Siberian elm, eastern redcedar, and green ash are the most common species in these windbreaks. Large eastern cottonwood are also present on most farmsteads in the Gothenburg-Platte-Alda and Ortello-Cozad associations. Other species, such as ponderosa pine, honeylocust, Russian-olive, boxelder, northern catalpa, Scotch pine, lilac, and honeysuckle have also been planted.

Tree planting around the farmstead is a continuing process because old trees pass maturity and deteriorate, some trees are lost to insects or disease or storms, and new windbreaks are needed for expanding farmsteads. Many windbreaks need supplemental plantings to reinforce them and restore their effectiveness for wind and snow control.

Field windbreaks (shelterbelts) are not extensive, but they are widely scattered throughout the county, except in the southern fourth. In addition, there are still a few hedgerows of osageorange along fences or property lines.

Field windbreaks vary from one row of trees to ten rows of trees and shrubs. Common species in these windbreaks are eastern redcedar, green ash, hackberry, Russian-olive, northern catalpa, ponderosa pine, honeylocust, Austrian pine, Siberian elm, and Russian mulberry. Some windbreaks have been partially or totally removed to accommodate center-pivot irrigation systems.

For a windbreak to fulfill its purpose, the trees or shrubs selected must grow well on the soils in the area to be planted. Matching the trees to the soil is the first step toward insuring survival and fast growth. Permeability, available water capacity, fertility, texture, depth, and drainage of the soil affect the growth of trees and shrubs.

Trees and shrubs are somewhat difficult to establish in Hamilton County because of dry conditions and competition from other vegetation. Properly preparing the site before planting and controlling competition from weeds and grasses after planting are important (fig. 11). Supplemental watering is necessary during establishment.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Native Woodland

By Keith A. Ticknor, forester, Soil Conservation Service

Less than one percent of Hamilton County is forested. Wooded areas are along the Platte River and other major streams and on the breaks of the Thurman-Coly association.

Eastern redcedar and eastern cottonwood make up most of the trees along the Platte River. Some fairly large, dense stands of eastern redcedar are on the

Figure 11.—Newly planted farmstead windbreak on Hastings silt loam, 0 to 1 percent slopes.

bottom lands. Other common species in these areas are black willow, Russian mulberry, green ash, boxelder, and indigobush.

There are also wooded areas along the major streams in the Hord-Hobbs association. Generally, trees are sparse at the headwaters and denser downstream. Eastern cottonwood, green ash, and black willow make up most of the trees in these areas, with some eastern redcedar, Russian mulberry, honeylocust, and boxelder.

The breaks dividing the uplands from the bottom lands of the Platte River are distinctly outlined by scattered eastern redcedar. A few green ash, Siberian elm, Russian mulberry, and smooth sumac grow along with the eastern redcedar.

Commercial use of these forested areas is very limited because of the small acreage. The bottom land soils along the river and in drainageways have good potential for production of sawtimber, firewood, Christmas trees, and other wood products, but these soils are being used for crops. Conversion to woodland is unlikely. Odd areas and small, hard-to-farm fields are good sites for woodland.

Recreation

By Robert O. Koerner, biologist, Soil Conservation Service

Hamilton County has opportunities for hunting and fishing, camping, hiking, swimming, and sports. The Pintail Wildlife Management Area consists of 134 acres of land and 230 acres of marsh and can be used for hunting, hiking, and photography. It is the only public recreational area in the county. Private outdoor recreational facilities are limited. There are a few campgrounds and two nine-hole golf courses.

Some hunting and fishing are available on private lands if permission is obtained. The Platte River supports several species of game fish.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for

recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Technical assistance in designing recreational facilities and improving habitat for wildlife is available from the Soil Conservation Service and other agencies.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

The Gothenburg-Platte-Alda association along the Platte River provides woody cover for wildlife. Large cottonwood trees provide perches for hawks, owls, and eagles and dens for tree squirrels and raccoons. Willow thickets provide escape cover for white-tailed deer. Other trees and shrubs, such as hackberry, elm, ash, boxelder, Russian mulberry, chokecherry, honeysuckle, plum, alder, Russian-olive, indigobush, and buckbrush provide food and cover for bobwhite quail, songbirds, and cottontail.

In addition to the Platte River, there are four major stream corridors in the county that support woody riparian habitat. These long, narrow strips of vegetation provide travel lanes for wildlife leading to the uplands of irrigated crops.

In the Thurman-Coly association, the steep drainageways and rolling hills adjacent to the river bottom are heavily covered with redcedar, plum, and chokecherry. These areas furnish excellent cover for deer, bobwhite quail, pheasant, cottontail, mourning dove, and songbirds.

The rivers and adjacent wetlands are habitat for mink, muskrat, beaver, shorebirds, and waterfowl. Depressions in the cropland support aquatic vegetation, which attracts waterfowl and shorebirds during years with adequate rainfall (fig. 12).

In the Ortello-Cozad association, the stream terraces adjacent to the Platte River are farmed. Grain aftermath provides food for wildlife.

Native and introduced grasses on the steeper rolling hills of the Holder-Geary and Hastings associations

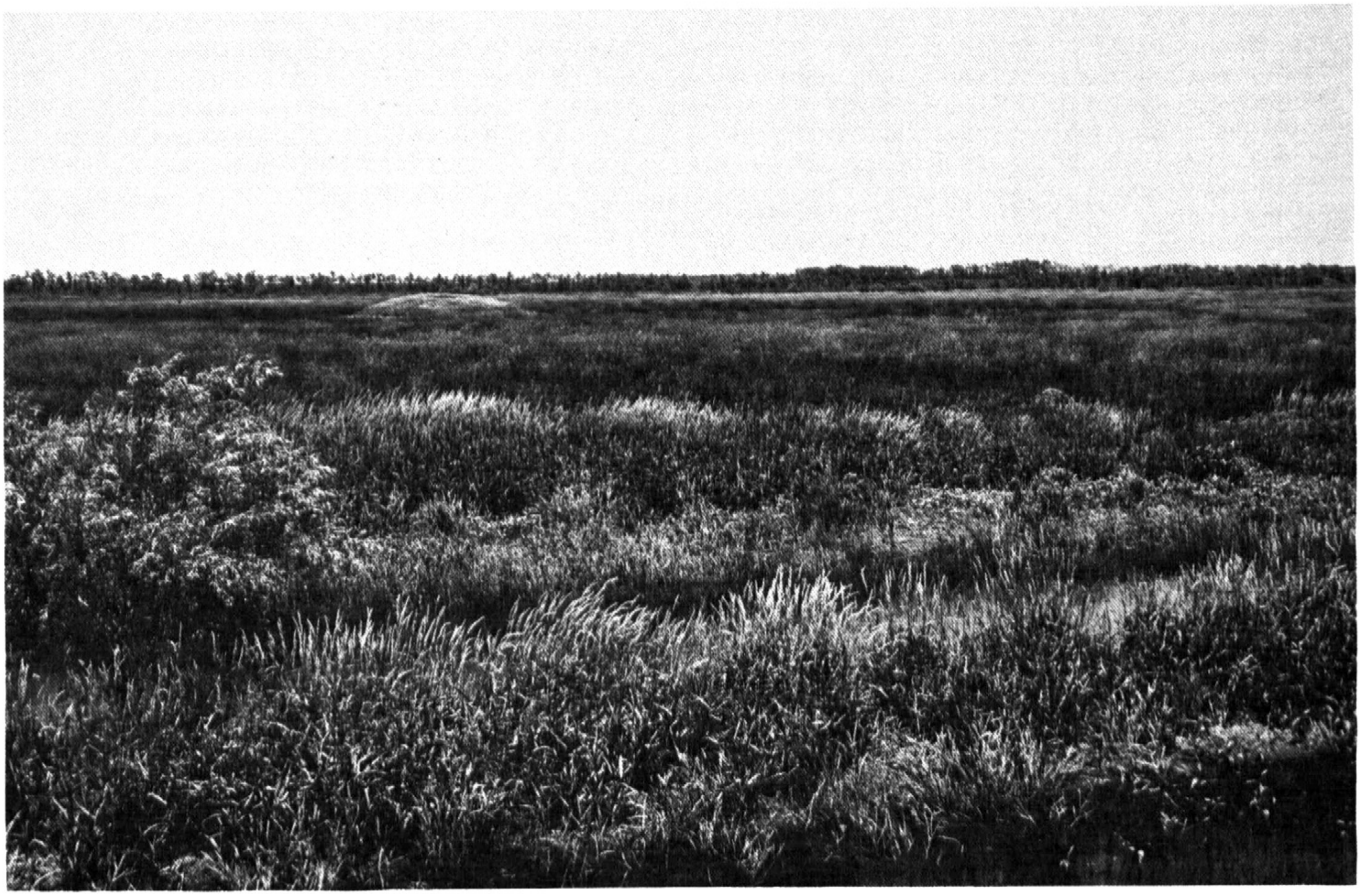

Figure 12.—Habitat for waterfowl and shorebirds in an area of Massie soils.

provide nesting cover for pheasant and bobwhite quail. These areas are in the southern part of the county along the Big Blue River and the lower part of Beaver Creek.

Farmstead shelterbelts and field windbreaks throughout the county provide winter protection for wildlife.

Leaving more residue in the fields over winter improves habitat. The corners of fields that are irrigated by center-pivot systems can be planted to permanent grass or trees and shrubs. Such plantings provide habitat diversity and nesting cover. Protecting the roadsides from spraying and burning increases nesting habitat.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, smooth bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and blue grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, green ash, honey locust, apple, hawthorn, dogwood, hickory, eastern cottonwood, and willow. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are sumac, autumn-olive, and wild plum.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pines and redcedar.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are native plum, Peking cotoneaster, common lilac, and Amur honeysuckle.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, prairie cordgrass, rushes, sedges, and reedgrasses.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include cottontail, opossum, woodcock, thrushes, woodpeckers, squirrels, fox, raccoon, deer, and coyote.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include badger, antelope, deer, prairie grouse, meadowlark, and lark bunting.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the a very firm dense layer, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, the available water capacity in the upper 40 inches, and the content of salts or sodium affect plant growth. Flooding, wetness, slope, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the

indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 5 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard

construction practices are assumed. Each soil is evaluated to a depth of 5 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by a high water table and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material. Acidity and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They have little or no gravel and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of organic matter or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by slope and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts or sodium. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, gravel content, and slope. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, and gravel content affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Wetness and slope affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 18.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69.

The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months;

November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by the Nebraska Department of Roads.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM), group index number by the Nebraska modified system; Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Specific gravity—T 100 (AASHTO).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(9)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittently dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning an argillic horizon, plus *ustoll*, the suborder of the Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Udic Argiustolls (Udic signifying a greater moisture supply than is typical).

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Udic Argiustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual *(7)*. Many of the technical terms used in the descriptions are defined in Soil Taxonomy *(9)*. Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alda Series

The Alda series consists of somewhat poorly drained soils on bottom lands. Alda soils formed in stratified loamy sediment. These soils are moderately deep over gravelly coarse sand. Permeability is moderate in the upper part of the profile and very rapid in the lower part. Slope ranges from 0 to 2 percent.

Alda soils are commonly near Cozad wet substratum soils and Inavale and Platte soils. Cozad wet substratum soils have more clay in the control section than Alda soils, do not have gravelly sand above a depth of 40

inches, and are in slightly higher positions. Inavale soils have more sand in the control section, do not have a mollic epipedon, and are in slightly higher positions. Platte soils are 10 to 20 inches deep over coarse sand or gravelly sand and are in slightly lower positions.

Typical pedon of Alda loam, 0 to 2 percent slopes, 1,600 feet south and 800 feet east of the northwest corner of sec. 26, T. 13 N., R. 6 W.

A1—0 to 4 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine and medium granular structure; soft, very friable; mildly alkaline; clear wavy boundary.

A2—4 to 11 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak fine and medium granular structure; soft, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

AC—11 to 14 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure; soft, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

C1—14 to 22 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; few fine faint yellowish brown (10YR 5/6 moist) mottles; weak medium and coarse subangular blocky structure; soft, very friable; mildly alkaline; clear wavy boundary.

C2—22 to 30 inches; very pale brown (10YR 7/3) loamy sand, pale brown (10YR 6/3) moist; few fine faint yellowish brown (10YR 5/6 moist) mottles; single grain; loose; neutral; gradual wavy boundary.

C3—30 to 38 inches; very pale brown (10YR 8/3) sand, very pale brown (10YR 7/3) moist; single grain; loose; neutral; gradual wavy boundary.

2C—38 to 60 inches; very pale brown (10YR 7/3) gravelly coarse sand, pale brown (10YR 6/3) moist; single grain; loose; about 15 percent gravel; neutral.

The mollic epipedon ranges from 7 to 20 inches in thickness. The solum ranges from 12 to 24 inches in thickness. Depth to coarse sand or gravelly sand ranges from 20 to 40 inches. Depth to carbonates ranges from 0 to 10 inches. Faint or distinct mottles are in the C horizon or the lower part of the control section.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). It typically is loam but in places is silt loam or fine sandy loam. Reaction is neutral to moderately alkaline. The C horizon has color value of 4 through 8 (3 to 7 moist) and chroma of 2 or 3 (dry or moist). It is typically fine sandy loam or sandy loam but has strata of finer and coarser textured material throughout. The 2C horizon is gravelly coarse sand with 3 to 15 percent gravel, or it is gravelly sand. It is similar to the C horizon in color. In some pedons, this horizon has mottles. Reaction ranges from neutral to moderately alkaline.

Butler Series

The Butler series consists of deep, somewhat poorly drained, slowly permeable soils in slightly concave areas or basins on the uplands. Butler soils formed in loess. Slope ranges from 0 to 1 percent.

Butler soils are commonly near Detroit, Fillmore, Hastings, Holder, Massie, and Scott soils. Crete, Detroit, Hastings, and Holder soils do not have an E horizon, have a brownish subsoil, and are in slightly higher positions. Fillmore, Massie, and Scott soils are more poorly drained than Butler soils, are ponded for longer periods, and have a more distinct E horizon.

Typical pedon of Butler silt loam, 0 to 1 percent slopes, 2,550 feet south and 100 feet east of the northwest corner of sec. 9, T. 10 N., R. 7 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; hard, friable; slightly acid; abrupt smooth boundary.

A—6 to 10 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium granular structure; hard, friable; slightly acid; abrupt smooth boundary.

E—10 to 11 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak fine platy structure; soft, friable; slightly acid; abrupt smooth boundary.

Bt1—11 to 26 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong medium subangular blocky structure; very hard, very firm; mildly alkaline; clear smooth boundary.

Bt2—26 to 32 inches; dark gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) moist; strong medium and coarse subangular blocky structure; very hard, very firm; mildly alkaline; clear smooth boundary.

BC—32 to 38 inches; light gray (10YR 6/1) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse subangular blocky structure; very hard, firm; mildly alkaline; gradual smooth boundary.

C—38 to 60 inches; light gray (10YR 6/1) silty clay loam, dark grayish brown (2.5Y 4/2) moist; few medium distinct dark brown (7.5YR 4/4 moist) mottles; massive; hard, friable; mildly alkaline.

The solum ranges from 26 to 42 inches in thickness. The mollic epipedon ranges from 16 to 36 inches in thickness.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 (dry and moist). The E horizon has color value of 4 through 6 (3 moist) and chroma of 1 (dry or moist). Reaction of the A and E horizons is medium acid or slightly acid. The A and E horizons are typically silt loam, but the A horizon is silty clay loam in places. The Bt horizon has hue of 10YR, 2.5Y, or 5Y; value of 3

or 4 (2 or 3 moist); and chroma of 1 or 2 (dry or moist). It is silty clay or clay. The BC horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 through 6 (3 or 4 moist); and chroma of 1 or 2 (dry or moist). It is silty clay loam or silty clay. Some pedons have few or common, faint or distinct, dark brown to yellowish brown (moist) mottles. The B horizon is neutral or mildly alkaline. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 through 7 (4 or 5 moist); and chroma of 1 through 3 (dry or moist). It is silt loam or silty clay loam. Reaction is mildly alkaline or moderately alkaline. In places, calcium carbonate is in concretions, and the soil mass between the concretions is noncalcareous.

Coly Series

The Coly series consists of deep, well drained to excessively drained, moderately permeable soils on uplands. Coly soils formed in calcareous loess. Slope ranges from 6 to 60 percent.

Coly soils are commonly near Hobbs, Holder, Uly, and Thurman soils. Hobbs soils are stratified, are occasionally flooded, and are on bottom lands of narrow drainageways. Holder soils have a mollic epipedon and a well developed B horizon, and carbonates are generally leached from the solum. Uly soils have less clay, have a mollic epipedon, and are in slightly higher positions. Thurman soils have more sand in the control section and are in lower positions.

Typical pedon of Coly silt loam, 11 to 30 percent slopes, 1,700 feet west and 200 feet north of the southeast corner of sec. 22, T. 12 N., R. 7 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

AC—5 to 9 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; mildly alkaline; clear smooth boundary.

C1—9 to 18 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, soft; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—18 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The solum ranges from 3 to 12 inches in thickness. Depth to free carbonates ranges from 0 to 9 inches.

The A horizon has color value of 4 through 7 (3 through 5 moist) and chroma of 2 or 3 (dry or moist). It is typically silt loam, but in places is loam or very fine sandy loam. The A horizon ranges from neutral through moderately alkaline. The C horizon has color value of 5 through 7 (4 through 6 moist) and chroma of 2 or 3 (dry or moist). It is typically silt loam, but in places is loam. Reaction is mildly alkaline or moderately alkaline. In some pedons, carbonates are in concretions; in other pedons there is visible accumulation of carbonates on the faces of cleavage planes.

Cozad Series

The Cozad series consists of deep, well drained, moderately permeable soils on stream terraces. Cozad soils formed in alluvium. Slope ranges from 0 to 3 percent.

Cozad soils are commonly near Hobbs, Hord, and Ortello soils. Hobbs soils are stratified above a depth of 10 inches and are in lower positions. Hord soils have a thicker mollic epipedon than Cozad soils and a fine-silty control section and are in slightly higher positions. Ortello soils are coarse-loamy in the control section and are in higher positions.

Typical pedon of Cozad silt loam, 0 to 1 percent slopes, 2,550 feet south and 100 feet west of the northeast corner of sec. 33, T. 13 N., R. 6 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and moderate granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

Bw—7 to 20 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; slightly acid; clear smooth boundary.

C1—20 to 40 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—40 to 56 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C3—56 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; strong effervescence; mildly alkaline.

The solum ranges from 14 to 28 inches in thickness. The mollic epipedon is 7 to 16 inches thick. Depth to carbonates generally ranges from 18 to 48 inches.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). It is typically silt loam, but in places is loam, very fine sandy loam, or fine sandy loam. The B horizon has color value of 5 or 6 (3 or 4 moist) and chroma of 2 or 3 (dry or moist). It is typically silt loam but in places is loam. The C horizon has color value of 5 through 7 (4 through 6 moist) and chroma of 2 or 3 (dry or moist). It is typically silt loam,

but in places is loam or has thin layers of fine sandy loam and sandy loam. Thin strata of finer and coarser textured material are common. Typically, the pedon includes a buried soil, but some pedons do not have this buried soil above a depth of 60 inches.

The soil on map unit Cx is a taxadjunct to the Cozad series because it has mottles with chroma of 2 or less in the upper 40 inches.

Crete Series

The Crete series consists of deep, moderately well drained, slowly permeable soils on uplands. Crete soils formed in loess. Slope ranges from 0 to 1 percent.

Crete soils are similar to Detroit and Hastings soils and commonly are near Butler, Detroit, Fillmore, Hastings, Massie, and Scott soils. Butler, Fillmore, Massie, and Scott soils have an E horizon, are more poorly drained than Crete soils, have more clay in the Bt horizon, and are in lower depressed areas. Detroit soils have less clay in the Bt horizon. Hastings soils have less clay in the Bt horizon have carbonates at greater depths, and are in higher positions.

Typical pedon of Crete silt loam, 0 to 1 percent slopes, 2,500 feet north and 150 feet west of the southeast corner of sec. 26, T. 10 N., R. 6 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, friable; medium acid; abrupt smooth boundary.

A—5 to 11 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium and coarse granular structure; slightly hard, friable; medium acid; clear smooth boundary.

BA—11 to 14 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable; slightly acid; clear smooth boundary.

Bt—14 to 27 inches; brown (10YR 5/3) silty clay, dark brown (10YR 3/3) moist; strong medium and coarse blocky structure; very hard, firm; shiny surfaces on peds; slightly acid; clear smooth boundary.

BC—27 to 30 inches; pale yellow (2.5Y 7/4) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

C—30 to 60 inches; light gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/4) moist; few fine faint brownish yellow (10YR 5/6 moist) mottles; weak medium and coarse prismatic structure; soft, very friable; many medium soft carbonate accumulations; strong effervescence; mildly alkaline.

The solum ranges from 30 to 40 inches in thickness. The mollic epipedon ranges from 20 to 30 inches in thickness. Depth to free carbonates ranges from 25 to 36 inches.

The A horizon has color value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). It is typically silt loam but in places is silty clay loam. It is medium acid or slightly acid. The BA horizon has color value of 4 or 5 (3 moist) and chroma of 2 or 3 (dry or moist). The Bt horizon has hue of 10YR or 2.5Y, value of 4 through 7 (3 through 5 moist), and chroma of 2 through 4 (dry or moist). The Bt horizon is silty clay; clay content averages between 45 and 52 percent. The BC and C horizons have color value of 5 through 7 (4 through 6 moist) and chroma of 2 through 4 (dry or moist). The BC horizon is dominantly silty clay loam but in some pedons is silty clay. The C horizon is dominantly silt loam but in some pedons is silty clay loam. The BC and C horizons are mottled in some pedons. In some pedons calcium carbonate is in concretions and the soil mass between the concretions is noncalcareous.

Detroit Series

The Detroit series consists of deep, moderately well drained, slowly permeable soils on margins of upland basins and on stream terraces. Detroit soils formed in loess and alluvium. Slope ranges from 0 to 3 percent.

Detroit soils are similar to Crete and Hastings soils and are commonly near Butler, Fillmore, Hastings, Holder, Hord, and Scott soils. Crete soils contain more clay in the control section. Butler, Fillmore, and Scott soils are in upland basins, are more poorly drained, and contain more clay in the control section than Detroit soils. Hastings soils are not pachic and are in higher positions. Holder soils have less clay in the control section, are not pachic, and are in higher positions. Hord soils do not have an argillic horizon and are in lower positions.

Typical pedon of Detroit silt loam, 0 to 1 percent slopes, 800 feet east and 100 feet north of the southwest corner of sec. 35, T. 12 N., R. 5 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; hard, friable; slightly acid; abrupt smooth boundary.

A—6 to 18 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine granular structure; hard, friable; slightly acid; gradual smooth boundary.

Bt—18 to 30 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine subangular blocky structure; very hard, firm; neutral; clear smooth boundary.

BC—30 to 38 inches; pale brown (10YR 6/3) silty clay loam, dark grayish brown (10YR 4/2) moist; few faint brown (7.5YR 4/4 moist) mottles; moderate

coarse and medium subangular blocky structure; hard, firm; neutral; clear smooth boundary.

C1—38 to 50 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common distinct fine brown (7.5YR 4/4 moist) mottles; massive; hard, friable; mildly alkaline; clear smooth boundary.

C2—50 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common distinct medium strong brown (7.5YR 5/6 moist) mottles; massive; hard, friable; mildly alkaline.

The solum ranges from 30 to 60 inches in thickness. The mollic epipedon ranges from 20 to 50 inches in thickness and extends into the upper part of the B horizon.

The A horizon has color value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). It is typically silt loam but in places is silty clay loam. Reaction is slightly acid or neutral. The Bt horizon has color value of 3 through 5 (2 or 3 moist) and chroma of 2 or 3. It is typically silty clay loam and silty clay; clay content averages between 35 and 42 percent. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3 (dry or moist). It is typically silty clay loam but in places is silt loam.

Fillmore Series

The Fillmore series consists of deep, poorly drained and somewhat poorly drained, very slowly permeable soils in depressions on the uplands. Fillmore soils formed in loess. Slope ranges from 0 to 1 percent.

Fillmore soils are similar to Scott soils and commonly are near Butler, Crete, Detroit, Hastings, Massie, and Scott soils. Butler soils have a thinner, less distinct E horizon than Fillmore soils and are ponded for shorter periods. Crete, Detroit, and Hastings soils do not have an E horizon, have a brownish subsoil, and are in higher positions. Massie and Scott soils have a thinner combined A and E horizon, are ponded for longer periods, and are in lower positions.

Typical pedon of Fillmore silt loam, 0 to 1 percent slopes (fig. 13), 700 feet east and 100 feet south of the northwest corner of sec. 31, T. 9 N., R. 7 W.

Ap—0 to 5 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak fine and medium granular structure; slightly hard, friable, slightly acid; abrupt smooth boundary.

A—5 to 9 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; moderate fine and medium granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

E—9 to 12 inches; light gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; weak fine and medium platy structure; soft, very friable; slightly acid; abrupt smooth boundary.

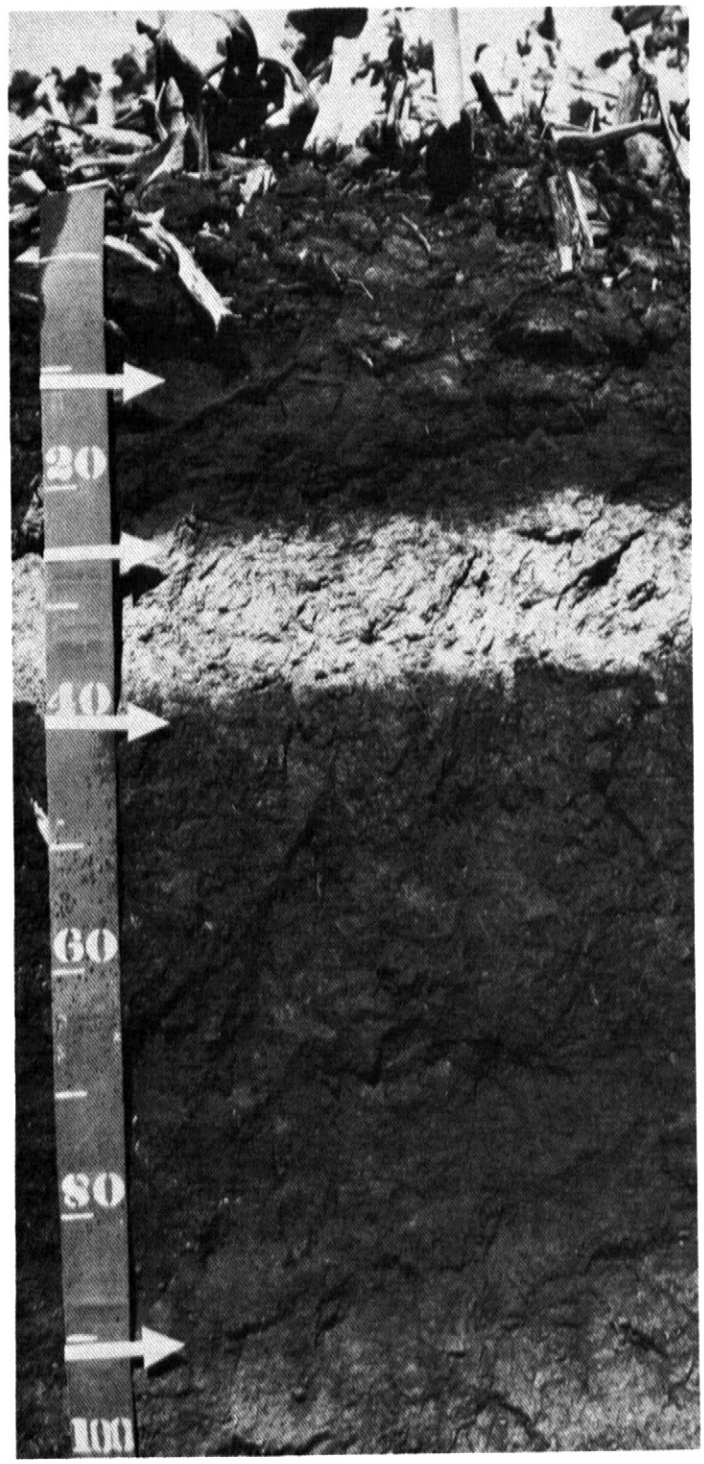

Figure 13.—Profile of Fillmore silt loam. The distinct light-colored layer has been bleached by water standing above the dark, clayey layer. Arrows indicate certain horizon boundaries. Scale in centimeters.

Bt1—12 to 31 inches; gray (10YR 5/1) clay, very dark grayish brown (10YR 3/2) moist; strong medium and coarse blocky structure; very hard, very firm; neutral; clear smooth boundary.

Bt2—31 to 40 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium and coarse subangular blocky structure; very hard, firm; neutral; clear smooth boundary.

BC—40 to 52 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse subangular blocky structure; hard, firm; mildly alkaline; clear smooth boundary.

C—52 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; slight effervescence; mildly alkaline.

The solum ranges from 36 to 60 inches in thickness. Depth to free carbonates generally ranges from 30 to 60 inches, but some pedons do not have free carbonates above a depth of 60 inches. The mollic epipedon extends into the upper part of the Bt horizon.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 (dry and moist). The E horizon has color value of 5 or 6 (4 or 5 moist) and chroma of 1 (dry and moist). Reaction of the A and E horizons is slightly acid or neutral. The Bt horizon has color value of 3 through 5 (2 through 4 moist) and chroma of 1 or 2 (dry or moist). It is silty clay or clay. The BC horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 through 5 moist), and chroma of 2 or 3 (dry or moist). It is silty clay loam or silty clay. Reaction is neutral or mildly alkaline in the upper part of the B horizon and mildly alkaline in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 through 6 moist), and chroma of 2 through 4 (dry or moist). It is commonly silt loam but in some pedons is silty clay loam. Reaction is mildly alkaline or moderately alkaline. In some pedons the calcium carbonate is in concretions and the soil mass between the concretions is noncalcareous.

Fonner Variant

The Fonner variant consists of moderately well drained, rapidly permeable soils on bottom lands. Fonner variant soils formed in stratified sandy alluvium. These soils are shallow over coarse sand. Slope ranges from 0 to 2 percent.

Fonner variant soils are commonly near Alda, Gothenburg, Inavale, and Platte soils. Alda soils are somewhat poorly drained, are calcareous near the surface, and have more silt and very fine sand in the control section than Fonner variant soils. Gothenburg and Platte soils are somewhat poorly drained or poorly drained and are in slightly lower positions. Inavale soils do not have gravelly sand above a depth of 40 inches, are somewhat excessively drained, and are in slightly higher positions.

Typical pedon of Fonner Variant loamy sand, 0 to 2 percent slopes, 1,600 feet south and 200 feet west of the northeast corner of sec. 15, T. 11 N., R. 8 W.

A—0 to 6 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

AC—6 to 11 inches; light brownish gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; gradual smooth boundary.

C1—11 to 19 inches; very pale brown (10YR 7/3) sand, brown (10YR 5/3) moist; single grain; loose; neutral; gradual wavy boundary.

C2—19 to 42 inches; very pale brown (10YR 7/3) coarse sand, pale brown (10YR 6/3) moist; few fine distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; 5 percent gravel; neutral; gradual wavy boundary.

C3—42 to 60 inches; very pale brown (10YR 7/3) coarse sand, pale brown (10YR 6/3) moist; single grain; loose; 10 percent gravel; neutral.

The solum ranges from 10 to 18 inches in thickness. Depth to coarse sand or gravelly sand ranges from 10 to 20 inches. These soils typically do not contain carbonates, but some pedons have slight effervescence.

The A horizon has color value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). It is typically loamy sand but in places is loamy fine sand, sandy loam, or fine sandy loam. Reaction is slightly acid or neutral. Some pedons do not have an AC horizon. The C horizon has color value of 5 through 8 (4 through 6 moist) and chroma of 1 through 3 (dry or moist). It is typically sand and coarse sand with 3 to 15 percent gravel, or it is gravelly sand. The C horizon is commonly stratified. Reaction ranges from medium acid through neutral.

Geary Series

The Geary series consists of deep, well drained to somewhat excessively drained soils on uplands. Geary soils formed in reddish brown loess. Permeability is moderately slow. Slope ranges from 6 to 30 percent.

These soils are taxadjuncts to the Geary series because they do not have a mollic epipedon and the thickness of the solum is less than that defined for the Geary series.

Geary soils are similar to Holder soils and are commonly near Hastings, Hobbs, Holder, and Uly soils. Hastings, Holder, and Uly soils are not reddish in the solum and are in higher positions than Geary soils. Hastings soils have a finer textured argillic horizon, and Uly soils do not have an argillic horizon. Hobbs soils are

not so well developed as Geary soils, are stratified, and are in narrow upland drainageways.

Typically pedon of Geary silt loam, 11 to 30 percent slopes, in native grass, 2,500 feet west and 100 feet south of the northeast corner of sec. 27, T. 9 N., R. 5 W.

A—0 to 7 inches; brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

Bt1—7 to 14 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

Bt2—14 to 24 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

BC—24 to 36 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure; soft, very friable; mildly alkaline; clear smooth boundary.

C—36 to 60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; soft and hard masses of calcium carbonate; strong effervescence; moderately alkaline.

The solum ranges from 12 to 36 inches in thickness. Depth to free carbonates commonly ranges from 12 to 36 inches.

The A horizon is 5 to 10 inches thick. It has hue of 7.5YR or 10YR, value of 3 through 5 (2 or 3 moist) and chroma of 2 or 3 (dry or moist). It is silt loam or silty clay loam. Reaction is slightly acid or medium acid. The Bt horizon has hue of 7.5YR, value of 4 through 6 (3 through 5 moist), and chroma of 3 through 6 (dry or moist). It typically is silty clay loam and less commonly is clay loam. Reaction is neutral or slightly acid. The C horizon has hue of 10YR, 7.5YR, or 5YR; value of 5 through 7 (4 or 5 moist); and chroma of 2 through 6 (dry or moist). Reaction is neutral to moderately alkaline.

Gothenburg Series

The Gothenburg series consists of poorly drained, very rapidly permeable soils on bottom lands, generally near meandering stream channels. These soils formed in gravelly alluvium. They are very shallow over coarse sand and gravelly sand. Slope ranges from 0 to 2 percent.

Gothenburg soils are commonly near Alda, Inavale, and Platte soils. Inavale soils are deep and have a sandy control section. Alda soils are moderately deep over gravelly sand. Platte soils are 10 to 20 inches thick over coarse sand or gravelly sand and have a darker and thicker A horizon than Gothenburg soils. All of those soils are in slightly higher positions and are flooded less frequently than Gothenburg soils.

Typical pedon of Gothenburg sandy loam, 0 to 2 percent slopes, 200 feet south and 200 feet east of the northwest corner of sec. 7, T. 12 N., R. 6 W.

A—0 to 3 inches; dark gray (10YR 4/1) sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

C1—3 to 9 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; single grain; loose; neutral; gradual smooth boundary.

C2—9 to 60 inches; light gray (10YR 7/2) gravelly sand, light brownish gray (10YR 6/2) moist; common medium prominent strong brown (7.5YR 5/6 moist) mottles; single grain; loose; 15 percent gravel; neutral.

The solum, which consists of the A horizon, ranges from 1 to 5 inches in thickness. In places, calcium carbonate is in the surface layer. Depth to the gravelly sand or coarse sand ranges from 3 to 10 inches. Reaction is neutral or mildly alkaline throughout the profile.

The A horizon has color value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). The texture is loamy sand, loam, sandy loam, or loamy fine sand. Thin layers of finer textured material are present in some pedons. Some pedons do not have the thin C1 horizon of fine sand. The 2C horizon has color value of 6 through 8 (4 through 7 moist) and chroma of 1 through 3 (dry or moist). Distinct brown, strong brown, yellowish brown, or reddish yellow mottles are common in most pedons.

Hastings Series

The Hastings series consists of deep, well drained, moderately slowly permeable soils on uplands. These soils formed in loess. Slope ranges from 0 to 11 percent.

Hastings soils are similar to Crete and Holder soils and are commonly near Butler, Crete, Fillmore, Holder, and Scott soils. Butler, Fillmore, and Scott soils are more poorly drained than Hastings soils, have more clay in the B horizon, and are in depressions. Holder soils have less clay in the B horizon and are in higher positions. Crete soils are pachic, have more clay in the argillic horizon, have carbonates higher in the profile, and are in slightly lower positions.

Typical pedon of Hastings silt loam, 0 to 1 percent slopes (fig. 14), 200 feet west and 100 feet south of the northeast corner of sec. 28, T. 9 N., R. 7 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine

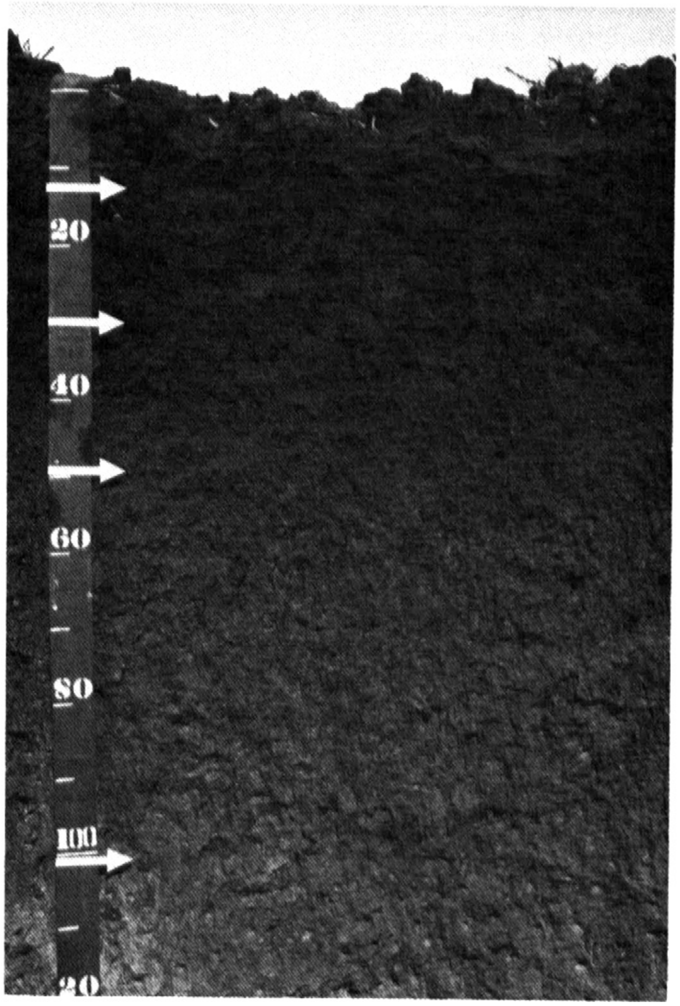

Figure 14.—Profile of Hastings silt loam. Arrows indicate certain horizon boundaries. Scale in centimeters.

and medium granular structure; slightly hard, friable; medium acid; abrupt smooth boundary.

A—6 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium and coarse granular structure; slightly hard, friable; medium acid; clear smooth boundary.

BA—12 to 15 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; slightly acid; clear smooth boundary.

Bt—15 to 25 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; hard, firm; slightly acid; clear smooth boundary.

BC—25 to 28 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

C1—28 to 55 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable; neutral; clear smooth boundary.

C2—55 to 60 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable; slight effervescence; moderately alkaline.

The solum ranges from 26 to 48 inches in thickness. The mollic epipedon ranges from 8 to 20 inches in thickness. Depth to carbonates ranges from 36 inches to 60 inches or more.

The A horizon has color value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). It is silt loam or silty clay loam. Reaction is medium acid or slightly acid. The BA horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3 (dry or moist). Reaction is slightly acid or neutral. The Bt horizon has color value of 5 or 6 dry (4 or 5 moist) and chroma of 2 or 3 (dry or moist). It is silty clay loam or silty clay; clay content averages between 35 and 42 percent. The BC and C horizons have hue of 10YR or 2.5Y, value of 5 through 7 (4 through 6 moist), and chroma of 2 through 4 (dry or moist). The C horizon is silt loam or silty clay loam. Reaction is slightly acid through moderately alkaline. The lower part of the B horizon and the C horizon have relict mottles in some pedons.

The soils in map units HdC2 and HdD2 do not have the mollic epipedon that is defined for the Hastings series.

Hobbs Series

The Hobbs series consists of deep, well drained, moderately permeable soils on bottom lands. Hobbs soils formed in stratified noncalcareous silty alluvium on flood plains, foot slopes, and fans of narrow intermittent drainageways of the uplands. Slope ranges from 0 to 2 percent.

Hobbs soils are near Geary, Holder, Uly, and Hord soils. Geary and Holder soils have an argillic horizon and are on side slopes of adjacent uplands. Hord soils have a B horizon and are on stream terraces. Uly soils have a weakly developed B horizon and are on side slopes of adjacent uplands.

Typical pedon of Hobbs silt loam, 0 to 2 percent slopes, 1,450 feet east and 100 feet north of the southwest corner of sec. 19, T. 10 N., R. 6 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; thin strata of darker or lighter colored silt loam; weak

fine and medium granular structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.

A—7 to 20 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; thin strata of darker or lighter colored silt loam; weak fine and medium granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

C1—20 to 30 inches; stratified grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, very friable; neutral; clear smooth boundary.

C2—30 to 40 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

C3—40 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; neutral.

These soils do not typically have free carbonates above a depth of 40 inches, but some pedons have thin, recently deposed layers that contain small amounts of free carbonates.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). Stratification is apparent in undistributed areas. The C horizon has color value of 4 through 7 (3 through 6 moist) and chroma of 1 through 3 (dry or moist). It contains thin strata having higher or lower color value. Some pedons have a buried A horizon.

Holder Series

The Holder series consists of deep, well drained, moderately permeable soils on loess-mantled uplands. Slope ranges from 0 to 11 percent.

Holder soils are similar to Geary and Hastings soils and are commonly near Crete, Geary, Hastings, Hord, Hobbs, and Uly soils. Crete and Hastings soils have a finer textured argillic horizon. Geary soils are redder in the subsoil and underlying material and are in lower positions. Hord soils have a thicker mollic epipedon, do not have an argillic horizon, and are on stream terraces. Hobbs soils are stratified and formed in alluvium in narrow upland drainageways. Uly soils do not have an argillic horizon, have lime higher in the profile, have a thinner solum, and are on the lower part of side slopes.

Typical pedon of Holder silt loam, 0 to 1 percent slopes (fig. 15), 400 feet south and 100 feet west of the northeast corner of sec. 3, T. 10 N., R. 8 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, very friable; strongly acid; abrupt smooth boundary.

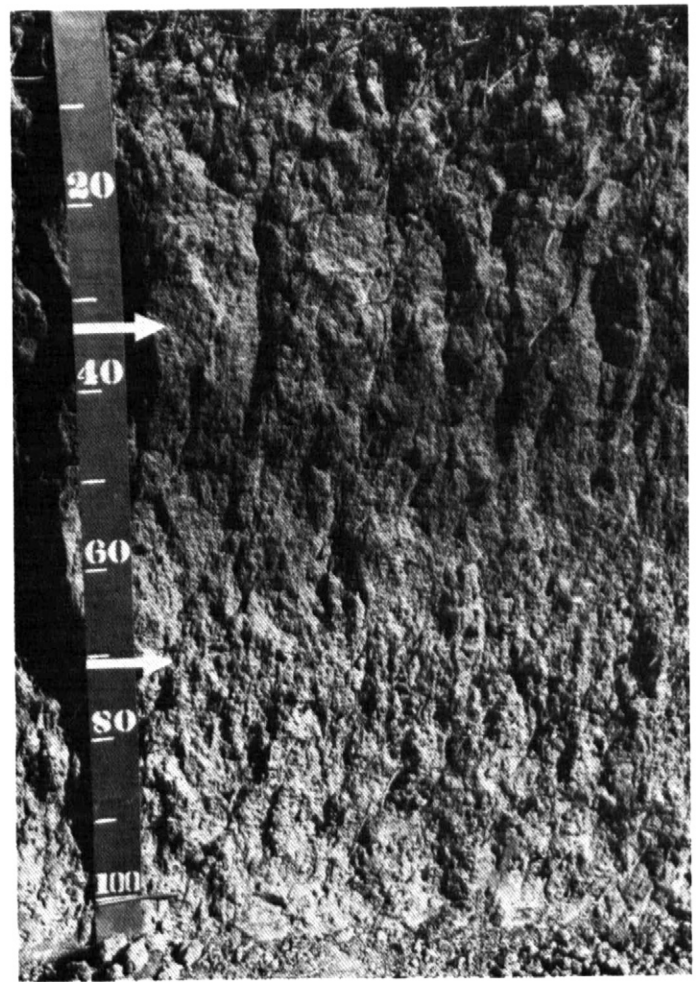

Figure 15.—Profile of Holder silt loam.

A—5 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse granular structure; slightly hard, very friable; medium acid; clear smooth boundary.

Bt1—10 to 18 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

Bt2—18 to 23 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

BC—23 to 29 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

C1—29 to 50 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure; soft, very friable; mildly alkaline; gradual smooth boundary.

C2—50 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; few fine faint strong brown (7.5YR 5/6 moist) mottles; weak coarse prismatic structure; soft, very friable; soft masses of calcium carbonate; violent effervescence; moderately alkaline.

The solum ranges from 25 to 46 inches in thickness. The mollic epipedon ranges from 10 to 20 inches in thickness. Depth to carbonates ranges from 36 to 60 inches and is greatest where the soil is nearly level and gently sloping.

The A horizon has color value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). Reaction is strongly acid to neutral. The texture typically is silt loam but in places is silty clay loam. In some pedons, a BA horizon is present. It has color value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3 (dry or moist). The Bt horizon has color value of 4 through 6 (3 through 5 moist) and chroma of 2 or 3 (dry or moist). It typically is silty clay loam; the clay content averages between 28 and 35 percent. Reaction is slightly acid to moderately alkaline. The BC horizon has color value of 5 through 7 (4 through 6 moist) and chroma of 2 or 3 (dry or moist). It is silt loam or silty clay loam. Reaction is neutral or mildly alkaline. The C horizon has color value or 6 or 7 (5 or 6 moist) and chroma of 2 or 3 (dry or moist). Reaction is moderately alkaline or mildly alkaline.

Map units HhC2 and HhD2 do not have a mollic epipedon, which is a characteristic of the Holder series. Map unit Hk has a mollic epipedon that is thicker than that defined for the series.

Hord Series

The Hord series consists of deep, well drained, moderately permeable soils on stream terraces. Hord soils formed in silty alluvium or loess-like material. Slope ranges from 0 to 6 percent.

Hord soils are commonly near Geary, Holder, and Hobbs soils. Geary and Holder soils have an argillic horizon and are on side slopes of adjacent uplands. Hobbs soils have more stratification and are on bottom lands of narrow drainageways.

Typical pedon of Hord silt loam, 0 to 1 percent slopes (fig. 16), 2,000 feet west and 150 feet north of the southeast corner of sec. 27, T. 9 N., R. 6 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

A—5 to 14 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate

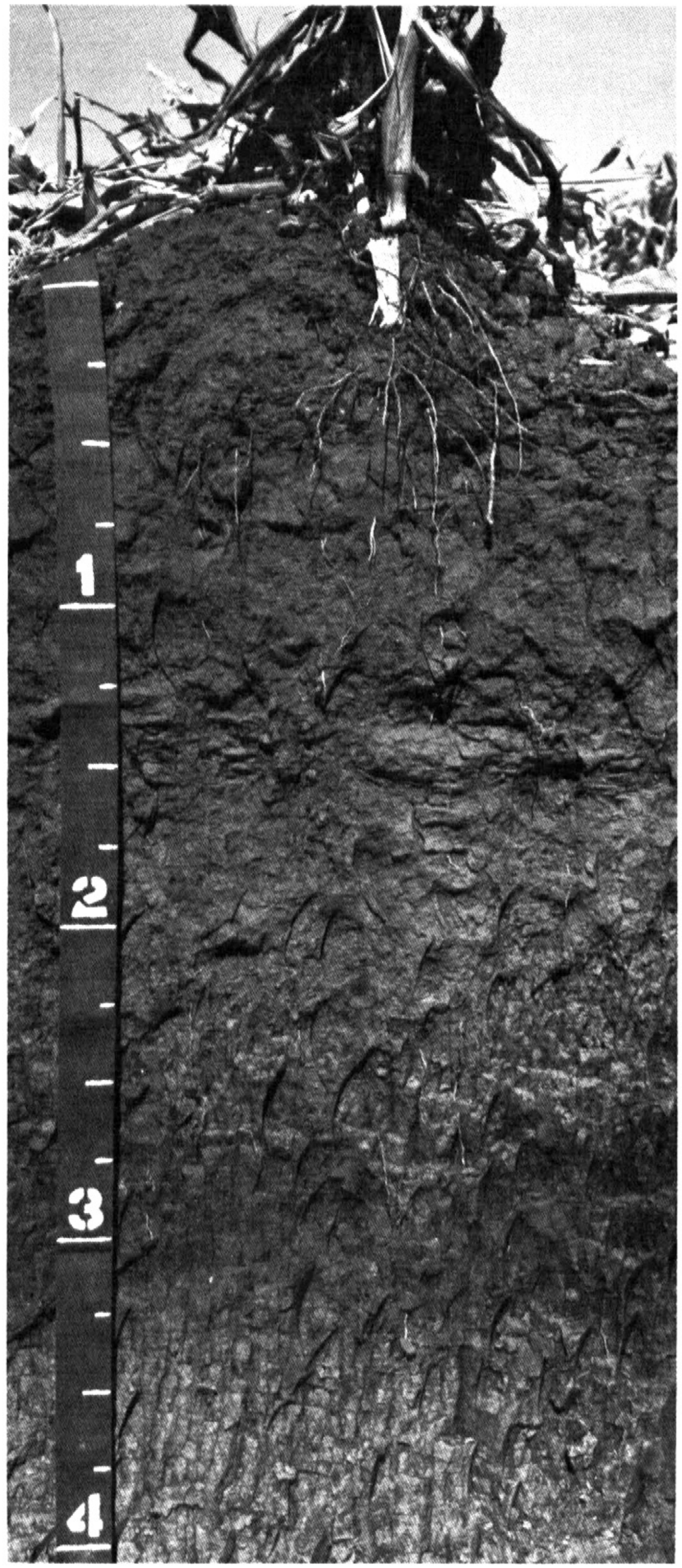

Figure 16.—Profile of Hord silt loam. A buried soil is at a depth of about 3 feet. Scale in feet.

medium and coarse granular structure; soft, very friable; neutral; clear smooth boundary.

Bw—14 to 30 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

BC—30 to 42 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

C—42 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; soft, very friable; thin stratified layers of finer textured materials; mildly alkaline.

The solum ranges from 24 to 55 inches in thickness. The mollic epipedon ranges from 20 to 40 inches in thickness and extends into the B horizon. Depth to free carbonates ranges from 24 inches to more than 60 inches.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). It is typically silt loam. Reaction is slightly acid or neutral. The upper part of the B horizon is similar to the A horizon in color. The lower part of the B horizon has color value of 4 through 6 (3 through 5 moist) and chroma of 2 or 3 (dry or moist). Typically, the B horizon is silt loam but in places is loam or silty clay loam. Reaction is neutral or mildly alkaline. The C horizon has color value of 4 through 7 (3 through 5 moist) and chroma of 2 or 3 (dry or moist). The texture ranges from very fine sandy loam to silty clay loam and is commonly stratified. In some areas, buried soils are common. Reaction is mildly alkaline or moderately alkaline.

Inavale Series

The Inavale series consists of deep, somewhat excessively drained, rapidly permeable soils on bottom lands. Inavale soils formed in sandy alluvium. Slope ranges from 0 to 3 percent.

Inavale soils are similar to Thurman soils and are near Alda, Gothenburg, and Platte soils. Alda soils have less sand in the upper part of the control section than Inavale soils, are somewhat poorly drained, and are in lower positions. Gothenburg soils have gravelly sand below a depth of 3 inches, are poorly drained and frequently flooded, and are in lower positions. Platte soils have gravelly sand below a depth of 10 inches, are somewhat poorly drained, and are in lower positions. Thurman soils are not stratified, are not subject to flooding, and are in higher positions.

Typical pedon of Inavale loamy sand, 0 to 3 percent slopes, 400 feet east and 50 feet south of the northwest corner of sec. 14, T. 11 N., R. 8 W.

A—0 to 7 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; loose; slightly acid; clear smooth boundary.

C1—7 to 42 inches; light brownish gray (10YR 6/2) sand, grayish brown (10YR 5/2) moist; single grain; loose; thin strata of finer textured sediment; neutral; clear smooth boundary.

C2—42 to 60 inches; light gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) moist; single grain; loose; thin strata of finer textured sediment; neutral.

Carbonates typically are below a depth of 60 inches.

The A horizon has color value of 4 through 7 (4 or 5 moist) and chroma of 2 or 3 (dry or moist). Typically, the A horizon is loamy sand but in places is loamy fine sand or fine sand. Reaction is slightly acid to mildly alkaline. Some pedons have an AC horizon with color value of 5 through 7 (4 through 6 moist) and chroma of 2 or 3 (dry or moist). The control section commonly is sand, but in places it is loamy fine sand or fine sand. It typically is stratified with fine and coarse textured material.

Massie Series

The Massie series consists of deep, very poorly drained, very slowly permeable soils in depressions on uplands. Massie soils formed in alluvium derived from loess. These soils are usually ponded during the growing season. Slope ranges from 0 to 1 percent.

Massie soils are similar to Scott soils and are commonly near Butler, Crete, and Hastings soils. Butler soils have thicker combined A and E horizons than Massie soils, are ponded for shorter periods, and are in slightly higher positions. Crete and Hastings soils do not have an E horizon, have a brownish subsoil with less clay, and are in higher positions. Scott soils have a thinner solum, do not have an organic layer on the surface, are ponded for shorter periods, and are in slightly higher positions.

Typical pedon of Massie silt loam, 0 to 1 percent slopes, 300 feet north and 800 feet east of the southwest corner of sec. 36, T. 10 N., R. 6 W.

Oi—2 inches to 0; partly decomposed stems, grass, and weeds; abrupt smooth boundary.

A—0 to 3 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; moderate fine granular structure; slightly hard, very friable; medium acid; abrupt smooth boundary.

E—3 to 4 inches; gray (10YR 5/1) silt loam, dark gray (10YR 4/1) moist; moderate medium and coarse granular structure; slightly hard, friable; medium acid; abrupt smooth boundary.

Bt1—4 to 22 inches; dark gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) moist; few fine faint yellowish brown (10YR 5/6 moist) mottles; strong

medium and coarse angular blocky structure; very hard, very firm; medium acid; clear wavy boundary.

Bt2—22 to 34 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong medium and coarse angular blocky structure; very hard, very firm; medium acid; clear wavy boundary.

Bt3—34 to 46 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; massive; very hard, very firm; slightly acid; clear wavy boundary.

BC—46 to 56 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm; very dark grayish brown (10YR 3/2 moist) organic films on faces of peds; slightly acid; clear wavy boundary.

C—56 to 60 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable; slightly acid.

The solum is more than 50 inches thick.

The Oi horizon ranges from a trace to 2 inches of partially decayed organic matter. The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). It is typically silt loam but in places is silty clay loam or silty clay. Reaction ranges from slightly acid through strongly acid. The E horizon has color value of 5 to 6 (4 or 5 moist) and chroma of 1 (dry or moist). Reaction is slightly acid or medium acid. Some pedons do not have an E horizon because tillage during extended dry periods has mixed it with silty material above or with clayey material below. The upper part of the B horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2 (dry or moist). Some pedons contain strong brown to yellowish brown mottles. The upper part of the B horizon is silty clay; clay content averages between 40 and 55 percent. Reaction is medium acid through neutral. The lower part of the B horizon has hue of 10YR or 2.5Y, value of 4 through 6 (3 through 5 moist), and chroma of 1 or 2 (dry or moist). It is silty clay or silty clay loam. In some pedons this part does not have the dark colored films on the cleavage planes. Reaction is slightly acid or neutral. The C horizon has hue of 10YR or 2.5Y, value of 4 through 7 (4 through 6 moist), and chroma of 1 through 3 (dry or moist). It is commonly silt loam but in places is silty clay loam. It is neutral or mildly alkaline.

Ortello Series

The Ortello series consists of deep, well drained moderately rapidly permeable soils on uplands and stream terraces. Ortello soils formed in sandy and loamy sediment. Slope ranges from 0 to 3 percent.

Ortello soils are similar to Thurman soils and are commonly near Cozad, Hord, and Thurman soils. Cozad and Hord soils have more silt and clay in the control section than Ortello soils and generally are in lower positions. Thurman soils have more coarse sand in the lower part of the control section, are more sloping, and are in higher positions.

Typical pedon of Ortello fine sandy loam, 0 to 1 percent slopes, 800 feet south and 200 feet east of the northwest corner of sec. 34, T. 13 N., R. 6 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.

A—5 to 12 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

Bw—12 to 24 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; slightly acid; gradual smooth boundary.

BC—24 to 40 inches; very pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; soft, very friable; neutral; gradual wavy boundary.

C—40 to 60 inches; very pale brown (10YR 7/4) sandy loam, light yellowish brown (10YR 6/4) moist; weak medium and coarse subangular blocky structure; soft, very friable; thin strata of silty material; neutral.

The solum ranges from 24 to 50 inches in thickness. The mollic epipedon ranges from 10 to 18 inches in thickness. These soils generally do not have free carbonates above a depth of 60 inches.

The A horizion has color value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). It is typically fine sandy loam but in places is loam, sandy loam, or loamy fine sand. Reaction is slightly acid or neutral. The B horizon has color value of 4 through 6 (3 through 5 moist) and chroma of 2 through 4 (dry or moist). It is typically fine sandy loam but in places is sandy loam. In places, the soil becomes coarser with depth. The B horizon is slightly acid or neutral. The C horizon has color value of 6 through 8 (5 or 6 moist) and chroma of 2 through 4 (dry or moist). Reaction is neutral or mildly alkaline.

The soils in map units Ov and OvB are taxadjuncts to the Ortello series because the mollic epipedon is thicker than is defined for the series.

Platte Series

The Platte series consists of somewhat poorly drained soils on bottom lands. These soils formed in stratified sandy and loamy alluvium. They are shallow over coarse sand and gravelly sand. Permeability is moderate in the

upper part of the profile and very rapid in the sand. Slope ranges from 0 to 1 percent.

Platte soils are commonly near Alda and Gothenburg soils and Cozad wet substratum soils. All of those soils are on bottom lands. The Alda and Cozad soils are in slightly higher positions, and the Gothenburg soils are in slightly lower positions. Alda soils have more silt and less sand in the upper part of the control section than Platte soils and have gravelly sand between depths of 20 and 40 inches. Gothenburg soils have a lighter colored A horizon and are shallower over the gravelly sand. Cozad wet substratum soils are deep and have more silt and clay in the control section.

Typical pedon of Platte loam, 0 to 1 percent slopes (fig. 17), 600 feet south and 200 feet east of the northwest corner of sec. 14, T. 11 N., R. 8 W.

A—0 to 7 inches; dark gray (10YR 4/1) loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

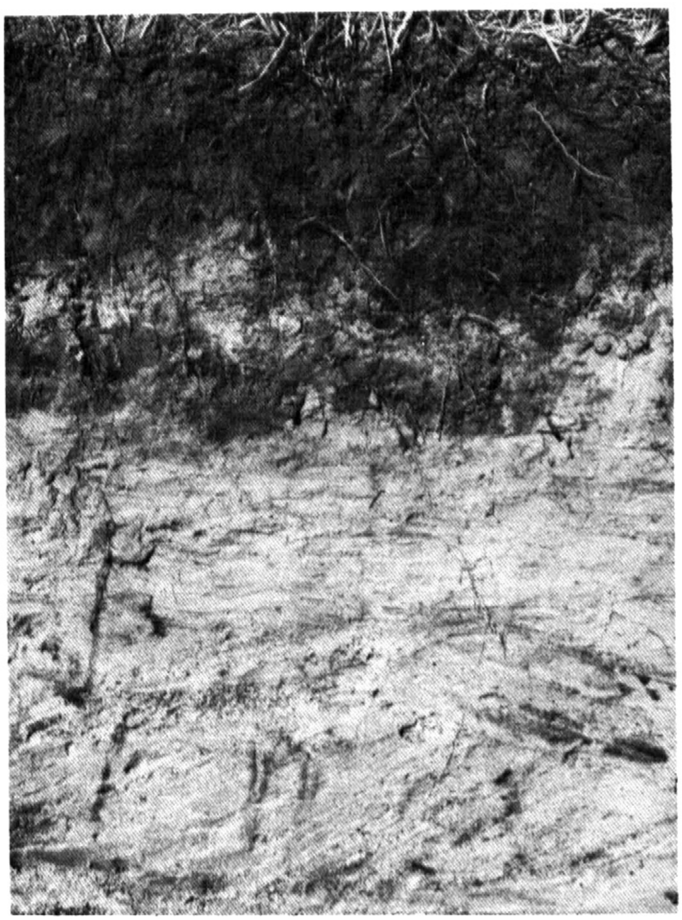

Figure 17.—Profile of Platte loam.

AC—7 to 12 inches; light gray (10YR 7/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; few fine distinct strong brown (7.5YR 5/6 moist) mottles; weak fine and medium subangular blocky structure; slightly hard, friable; thin strata of finer textured soil material; slight effervescence; mildly alkaline; clear smooth boundary.

C—12 to 16 inches; very pale brown (10YR 7/3) fine sand, light brownish gray (10YR 6/2) moist; few fine faint brown (7.5YR 4/4 moist) mottles; single grain; loose; thin strata of finer textured material; neutral; gradual smooth boundary.

2C—16 to 60 inches; very pale brown (10YR 7/3) gravelly sand, brown (10YR 5/3) moist; single grain; loose; about 15 percent gravel; thin strata of finer textured material; neutral.

The solum ranges from 7 to 12 inches in thickness. The depth to coarse sand or gravelly sand ranges from 10 to 20 inches. Carbonates are typically at the surface, but in some areas the soils lack carbonates.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). The texture is typically loam but in places is fine sandy loam or sandy loam. Reaction ranges from neutral through moderately alkaline. Some pedons do not have an AC horizon. The C and 2C horizons have color value of 6 or 7 (5 or 6 moist) and chroma of 2 or 3 (dry or moist). The C horizon ranges from sandy loam to loamy sand. The 2C horizon is coarse sand or gravelly sand, and the content of gravel ranges from 2 to 35 percent. The AC, C, and 2C horizons have few to many reddish and brownish mottles.

Rusco Series

The Rusco series consists of deep, moderately well drained, moderately slowly permeable soils in upland depressions or swales. Rusco soils formed in silty or loamy alluvium or in loess. Slope ranges from 0 to 1 percent.

Rusco soils are commonly near Holder and Uly soils. Those soils are well drained and generally are in slightly higher positions than Rusco soils. Holder soils do not have free carbonates and mottling in the control section and are in slightly higher positions. Uly soils have less clay in the B horizon and are in slightly higher positions.

Typical pedon of Rusco silt loam, 0 to 1 percent slopes, 1,100 feet south and 100 feet west of the northeast corner of sec. 7, T. 10 N., R. 8 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; hard, friable; slightly acid; abrupt smooth boundary.

A—7 to 14 inches; dark gray (10YR 4/1) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse granular structure; slightly hard, friable; slightly acid; clear smooth boundary.

Bt—14 to 22 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; hard, friable; neutral; clear smooth boundary.

BC—22 to 28 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; few medium distinct reddish brown (5YR 5/4 moist) mottles; weak medium and coarse subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

C1—28 to 38 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; common medium distinct reddish brown (5YR 5/4 moist) mottles; weak coarse subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

C2—38 to 48 inches; pale yellow (2.5Y 7/4) silt loam, grayish brown (2.5Y 5/2) moist; few fine faint brown (7.5YR 5/4 moist) mottles; massive; soft, very friable; neutral; clear smooth boundary.

C3—48 to 60 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; many coarse distinct reddish yellow (7.5YR 6/8 moist) mottles; massive; soft, very friable; neutral.

The solum ranges from 20 to 36 inches in thickness. The mollic epipedon ranges from 7 to 16 inches in thickness.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). Typically, it is silt loam but in places is silty clay loam. Reaction ranges from slightly acid to mildly alkaline. The B horizon has color value of 4 through 6 (3 through 5 moist) and chroma of 1 through 3 (dry or moist); the darker colors are in the upper part. The B horizon is typically silty clay loam in the upper part and silt loam in the lower part. In some pedons this horizon has thin strata that are more than 35 percent clay. The B horizon is neutral through moderately alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 through 7 (4 through 6 moist), and chroma of 1 through 4 (dry or moist). It typically has few or common, faint or distinct, strong brown, dark yellowish brown, or reddish brown (moist) mottles. The C horizon in some pedons contains thin strata of loamy material.

Scott Series

The Scott series consists of deep, poorly drained, very slowly permeable soils in depressions on the uplands. Scott soils formed in loess. Slopes ranges from 0 to 1 percent.

Scott soils are similar to Fillmore and Massie soils and are near Butler, Crete, Detroit, Fillmore, Hastings, and Massie soils. Butler and Fillmore soils have thicker combined A and E horizons than Scott soils, are ponded for shorter periods, and are in slightly higher positions. Crete, Detroit, and Hastings soils do not have an E horizon, have a brownish subsoil, and are in higher positions. Massie soils are more poorly drained, are ponded for longer periods, have a thin organic layer on the surface, and are in slightly lower positions.

Typical pedon of Scott silt loam, 0 to 1 percent slopes, 1,000 feet south and 200 feet east of the northwest corner of sec. 4, T. 10 N., R. 7 W.

A—0 to 5 inches; gray (10YR 5/1) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

E—5 to 7 inches; light gray (10YR 6/1) silt loam, gray (10YR 5/1) moist; moderate fine and medium platy structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.

Bt1—7 to 26 inches; dark gray (2.5Y 4/) clay, very dark gray (2.5Y 3/) moist; strong medium and coarse blocky structure; very hard, very firm; shiny surfaces on faces of most peds; slightly acid; clear smooth boundary.

Bt2—26 to 34 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium blocky structure; very hard, firm; shiny surfaces on faces of most peds; slightly acid; clear smooth boundary.

BC—34 to 43 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; few fine distinct strong brown (7.5YR 5/6 moist) mottles; moderate medium and coarse subangular blocky structure; hard, firm; neutral; clear smooth boundary.

C—43 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, friable; slight effervescence; neutral.

The solum ranges from 30 to 50 inches in thickness. The mollic epipedon ranges from 20 to 36 inches in thickness. Depth to free carbonates generally ranges from 35 to 60 inches, but some pedons do not have free carbonates above a depth of 60 inches.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). It is typically silt loam but in places is silty clay loam. The E horizon has color value of 5 or 6 (4 or 5 moist) and chroma of 1 (dry or moist). Reaction ranges from medium acid to neutral. The upper part of the B horizon has hue of 10YR or 2.5Y or is neutral; value is 3 through 5 (2 through 4 moist), and chroma is 0 through 2 (dry or moist). It is silty clay or clay; the clay content averages between 40 and 55 percent. Reaction is slightly acid to mildly alkaline. Some pedons have common, medium, distinct, reddish brown (5YR 5/4 moist) to yellowish brown (10YR 5/6 moist) mottles in the lower part of the B horizon and the upper part of the C horizon. The C horizon has hue of 10YR or

2.5Y, value of 5 through 7 (4 through 6 moist), and chroma of 2 through 4 (dry or moist). It is commonly silt loam but ranges to silty clay loam. In some pedons, calcium carbonate is in concretions and the soil mass between the concretions is noncalcareous.

Thurman Series

The Thurman series consists of deep, somewhat excessively drained soils on uplands. These soils formed in loamy and sandy material. Permeability is moderately rapid in the upper part of the profile and rapid in the underlying material. Slope ranges from 3 to 30 percent.

Thurman soils are similar to Ortello and Inavale soils and are commonly near Coly and Ortello soils. Coly soils have more silt and clay in the control section than Thurman soils and are in higher positions. Ortello soils have more silt and clay throughout the control section and are in lower positions. Inavale soils are stratified and are in lower positions.

Typical pedon of Thurman fine sandy loam, 11 to 30 percent slopes, 2,200 feet south and 1,100 feet east of the northwest corner of sec. 7, T. 12 N., R. 6 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, very friable; neutral; clear smooth boundary.

A2—6 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; neutral; clear smooth boundary.

AC—9 to 16 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; neutral; gradual smooth boundary.

C1—16 to 42 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; few fine faint reddish yellow (7.5YR 6/6 moist) mottles; weak fine and medium subangular blocky structure; slightly hard, very friable; neutral; gradual wavy boundary.

C2—42 to 60 inches; brownish yellow (10YR 6/6) loamy fine sand, yellowish brown (10YR 5/4) moist; common medium faint reddish yellow (7.5YR 6/6 moist) mottles; single grain; slightly hard, very friable; neutral.

The solum ranges from 14 to 24 inches in thickness. These soils generally do not have free carbonates above a depth of 60 inches. Reaction ranges from medium acid through neutral throughout the profile.

The A horizon has color value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2 (dry or moist). It is typically fine sandy loam but in places is sandy loam, very fine sandy loam, or loam. The AC horizon has color value of 4 through 6 (2 through 4 moist) and chroma of 2 or 3 (dry or moist). It is typically fine sandy loam but in places is loam or sandy loam. The C horizon has hue of 10YR or 7.5YR, value of 5 through 7 (4 through 6 moist), and chroma of 3 through 6 (dry or moist). It is loamy fine sand or loamy sand in the upper part of the control section and loamy fine sand, fine sand, or sand below a depth of 40 inches. Mottles are few to common, faint or distinct, and strong brown, dark yellowish brown, or reddish yellow (moist). The C horizon in some pedons contains thin strata of silty material.

Uly Series

The Uly series consists of deep, well drained and somewhat excessively drained, moderately permeable soils on uplands. Uly soils formed in calcareous loess. Slope ranges from 0 to 30 percent.

Uly soils are commonly near Hastings, Holder, Rusco, and Thurman soils. Hastings, Holder, and Rusco soils have more clay in the subsoil and generally are in lower positions than Uly soils. Thurman soils are loamy in the upper part of the profile and sandy in the lower part, are somewhat excessively drained, and are generally in lower positions.

Typical pedon of Uly silt loam, 0 to 1 percent slopes, 2,400 feet west and 100 feet north of the southeast corner of sec. 6, T. 10 N., R. 8 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

Bw—7 to 13 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; soft, very friable; mildly alkaline; clear smooth boundary.

BC—13 to 17 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

C1—17 to 27 inches; very pale brown (10YR 6/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—27 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable; slight effervescence; moderately alkaline.

The solum ranges from 12 to 34 inches in thickness. The mollic epipedon ranges from 7 to 16 inches in thickness. Depth to free carbonates typically ranges from 8 to 25 inches, but is greater in some pedons.

The A horizon has color value of 3 through 5 (2 or 3 moist) and chroma of 2 (dry or moist). Reaction is slightly acid through mildly alkaline. The B horizon has color value of 4 through 7 (2 through 5 moist) and

chroma of 2 or 3 (dry or moist). It is typically silty clay loam but in places is silt loam. Reaction is slightly acid through moderately alkaline. In some pedons the lower part of the B horizon has free carbonates. The C horizon has color value of 4 through 8 (4 through 6 moist) and chroma of 2 through 4 (dry or moist). Reaction is mildly alkaline or moderately alkaline. The C horizon is typically silt loam but in some places is very fine sandy loam.

The soil in map unit UyE2 does not have the mollic epipedon that is defined for the Uly series. This difference does not alter the usefulness or behavior of the soil.

Formation of the Soils

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief of the land, and the length of time that the forces of soil formation have been acting on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for parent material to change into a soil. It may be much or little, but some time is always required for differentiation of soil horizons. Usually a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated that few generalizations can be made about the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent Material

Parent material is the disintegrated and partly weathered rock in which soil forms. It determines the mineralogical and chemical composition of the soil. The soils of Hamilton County formed in four kinds of parent material: loess, eolian sand, alluvium, and material of the Loveland Formation.

Loess was blown out of river and stream valleys and deposited on uplands. It consists mostly of brown or yellowish silt, some clay, and small amounts of sand. The loess is commonly 10 to 40 feet thick, but it ranges from a few feet to more than 50 feet. Butler, Crete, Fillmore, Hastings, Holder, Scott, and Uly soils formed in loess.

The soils in the northern part of Hamilton County formed in eolian sand and sand mixed with loess. The sand was blown out of the Platte Valley by northwesterly winds and deposited on the loess and on old stream sediment. In places it was mixed with the loess. The mantle of sand ranges from a few feet to 15 feet in thickness. Ortello and Thurman soils formed mainly in eolian sands. Uly and Rusco soils formed in loess-like deposits.

The Loveland Formation is exposed on the lower part of side slopes of upland drainageways and on the lower part of valley sides along the West Fork Big Blue River. It is light gray or reddish brown or light reddish brown, friable silt loam or silty clay loam. It is the parent material of Geary soils.

Alluvium is water-deposited sediment on stream terraces and bottom lands. In the Platte Valley, the alluvium is clay to sand in texture. It is commonly stratified. This material is 1 to 8 feet thick over coarse sand and gravelly sand. The alluvium came both from the adjacent uplands and from more distant areas outside the county. It is mixed. Cozad and Hord soils formed in alluvium on stream terraces. Alda and Hobbs soils formed in alluvium on bottom lands. The more recent alluvium is in the narrow upland drainageways and near the major streams where fresh material is deposited by flooding after heavy rains. Gothenburg and Platte soils formed in the most recent alluvium along the Platte River.

Climate

Rainfall, temperature, and wind influence the weathering and reworking of soil material. The amount of moisture, the length of the growing season, and the prevailing temperature during the growing season affect the amount of vegetation, which is the principal source of organic matter in soils. These factors also directly affect the activity of the micro-organisms that convert organic matter to humus. Erosion caused by rain, melting snow, and wind can prevent development of a thick surface layer. Wind also can deposit sediment on the soil.

Hamilton County has a continental climate characterized by wide day-to-day and season-to-season variations. The average annual temperature is 50° F. The average annual precipitation is approximately 25 inches. Damaging hail storms are infrequent. The frost-free season averages 160 days, an adequate growing season for most common grain and forage crops. If moisture is sufficient, frost penetrates to a depth of 2 to 3.5 feet. The prevailing winds are from the south or southwest

May through September and from the northwest during the rest of the year.

The climate is fairly uniform throughout the county. Thus, differences in the soils are the result, not of climate alone, but of the interrelationship of climate and other factors. The amount of leaching, for example, depends not only on the amount of precipitation but also on relief. Because runoff is greater on the steeper soils and evaporation is greater from the soils that are exposed more directly to the wind, leaching is less in these soils than in nearly level soils that receive the same amount of rain.

Plant and Animal Life

After the parent material is deposited, bacteria, fungi and other simple forms of life invade it. After a time prairie grasses begin to grow, sending fibrous roots a few feet into the soil. The roots bring water from the deeper horizons and with the water bring soluble minerals such as calcium, iron, phosphorus, nitrogen, and sulfur. Plant roots also improve soil structure and aerate the soil.

When plants decay, small organisms act upon the organic matter and decompose it into stable humus. These organisms include bacteria, nematodes, and protozoa. Nitrogen-fixing bacteria in nodules on the roots of certain legumes remove nitrogen from the air. When the bacteria die, the nitrogen becomes available in the soil. Fungi and such small animals as millipedes, spiders, and mites also decompose organic matter. Earthworms, insects, and small burrowing animals mix and work the organic and mineral matter. The mixing and working speed soil development and make the soil more friable.

The decayed organic matter gradually darkens the surface layer and changes its physical and chemical characteristics. The soil is enriched with nutrients from the decaying organic matter. Tilth is improved, and water movement into and through the soil is increased. In Hamilton County Massie and Scott soils are wet with moderate to high organic matter content, and Coly and Uly soils have moderately low organic matter content.

Relief

Relief, or lay of the land, influences soil formation mainly through its effect on drainage, runoff, and plant growth. The degree of slope, shape of the surface, and permeability of the soil determine the rate of runoff, the internal drainage, and the moisture content of the soils. Internal drainage and availability of moisture are important factors in the development of soil horizons.

The nearly level and gently sloping soils have more distinct horizons than strongly sloping to steep soils. Lime and plant nutrients are leached to a greater depth and a B horizon forms. The nearly level and gently sloping Crete and Hastings soils have distinct horizons. The strongly sloping Holder soils and steep Uly soils are not so well developed because runoff and erosion are greater. Less water is absorbed by these soils, so soil formation is very slow.

On steep slopes, where runoff is rapid and little moisture penetrates the soils, development is slower. Erosion removes material from the surface layer almost as fast as it forms. Lime and other elements are not leached so deeply. In Hamilton County, the steep Coly soils have little development other than a slight darkening of the thin surface layer.

The nearly level stream terraces in the central part of Hamilton County receive little or no additional moisture from adjacent slopes or from the water table. Development is slower than in soils that receive the additional moisture. Generally, the lime and plant nutrients are leached from the normal rooting zone. Hord soils have a moderate degree of profile development.

Nearly level soils on bottom lands may receive extra water when flooded by adjacent creeks and streams. In these areas the soils are moderately well drained to poorly drained because of slow runoff or a fluctuating water table. The water table provides additional moisture to the root zone by capillary action. The moisture in the soil affects the mineral and chemical composition as well as the kind and amount of vegetation. These factors in turn influence soil development. In Hamilton County, the Fonner variant soils are moderately well drained. The Alda and Platte soils are somewhat poorly drained, and the Gothenburg soils are poorly drained.

Time

Time is required for the processes of soil formation to act. The length of time that geologic materials have been in place is commonly reflected in the distinctness of the soil horizons.

Soils that are approaching equilibrium with their environment are considered to be "mature." These soils have been in place long enough for climate, plants and animals, and relief to alter the parent material to a considerable degree. Mature soils in Hamilton County have a thick, dark-colored surface layer and a distinct subsoil. Crete and Hastings soils are examples.

Most of the soils on stream terraces have a well defined sequence of horizons. Hord soils are an example.

Immature bottom-land soils have not had sufficient time to form distinct horizons; Hobbs, Inavale, and Platte soils are examples. Coly soils are immature soils on uplands.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. Any tillage system that does not invert the soil and that leaves a protective cover of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazingland for a prescribed period.

Depth, soil. The total thickness of weathered soil material over bedrock. In this survey the classes of soil depth are—

	Inches
Very shallow	0 to 10
Shallow	10 to 20
Moderately deep	20 to 40
Deep	more than 40

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, and clay.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:
O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.
E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, alluminum, or some combination of these.
B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.
C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.
R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow

infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The classes of organic matter content used in this survey are *very low,* less than 0.5 percent organic matter present; *low,* 0.5 to 1.0 percent; *moderately low,* 1.0 to 2.0 percent; *moderate,* 2.0 to 4.0 percent; and *high,* 4.0 to 8.0 percent.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the classes of slope are—

	Percent
Nearly level	0 to 1
Very gently sloping	1 to 3
Gently sloping	3 to 6
Strongly sloping	6 to 11
Moderately steep	11 to 17
Steep	11 to 30
Very steep	30 to 60

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The solum above the B horizon, including all parts of the A, E, AB, and EB horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil (fig. 18). The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

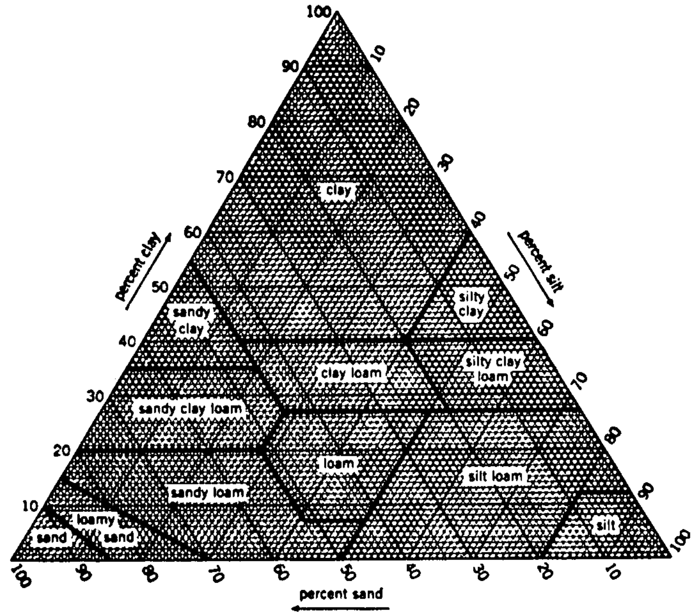

Figure 18.—This chart shows the percentages of sand, silt, and clay in the basic USDA soil texture classes.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1963-79 at Aurora, Nebraska]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F		In	In	In		In
January----	32.5	10.9	21.7	60	-15	0	.66	0.20	1.03	2	6.6
February---	39.7	16.7	28.2	69	-11	18	.80	.14	1.30	2	6.4
March------	50.8	26.5	38.7	85	1	58	1.78	.49	2.82	4	5.2
April------	65.3	39.3	52.3	89	18	121	3.05	1.51	4.37	6	1.3
May--------	75.6	49.9	62.8	94	31	404	4.02	1.99	5.78	7	.2
June-------	85.3	59.5	72.4	102	43	672	3.88	1.42	5.91	6	.0
July-------	90.1	64.7	77.4	103	50	849	2.69	1.28	3.90	5	.0
August-----	87.3	61.8	74.6	101	49	763	2.51	.87	3.86	4	.0
September--	78.3	52.4	65.4	97	34	462	2.92	1.26	4.33	6	.0
October----	67.8	40.8	54.3	89	23	184	1.83	.25	2.99	3	.1
November---	50.6	27.7	39.2	75	6	10	1.14	.13	1.88	2	3.0
December---	37.7	17.1	27.4	66	-11	0	.81	.15	1.31	2	8.3
Year------	63.4	38.9	51.2	104	-16	3,541	26.09	19.91	31.89	49	31.1

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1963-79 at Aurora, Nebraska]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 13	April 22	May 7
2 years in 10 later than--	April 9	April 18	May 2
5 years in 10 later than--	April 1	April 8	April 21
First freezing temperature in fall:			
1 year in 10 earlier than--	October 23	October 15	October 2
2 years in 10 earlier than--	October 27	October 19	October 7
5 years in 10 earlier than--	November 4	October 28	October 16

TABLE 3.--GROWING SEASON

[Recorded in the period 1963-79 at Aurora, Nebraska]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	201	185	155
8 years in 10	206	191	162
5 years in 10	215	202	177
2 years in 10	225	214	192
1 year in 10	232	223	203

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ag	Alda loam, 0 to 2 percent slopes	1,500	0.4
Bu	Butler silt loam, 0 to 1 percent slopes	6,600	1.9
CoD2	Coly silt loam, 6 to 11 percent slopes, eroded	460	0.1
CoF	Coly silt loam, 11 to 30 percent slopes	2,700	0.8
CoG	Coly silt loam, 30 to 60 percent slopes	550	0.2
Cw	Cozad silt loam, 0 to 1 percent slopes	1,000	0.3
CwB	Cozad silt loam, 1 to 3 percent slopes	237	0.1
Cx	Cozad silt loam, wet substratum, 0 to 1 percent slopes	374	0.1
Cy	Crete silt loam, 0 to 1 percent slopes	23,000	6.6
De	Detroit silt loam, 0 to 1 percent slopes	2,600	0.7
Dt	Detroit silt loam, terrace, 0 to 1 percent slopes	1,700	0.5
DtB	Detroit silt loam, terrace, 1 to 3 percent slopes	580	0.2
Fm	Fillmore silt loam, 0 to 1 percent slopes	2,050	0.6
Fo	Fillmore silt loam, drained, 0 to 1 percent slopes	5,800	1.6
Fv	Fonner Variant loamy sand, 0 to 2 percent slopes	283	0.1
GeF	Geary silt loam, 11 to 30 percent slopes	2,250	0.7
GhD2	Geary silty clay loam, 6 to 11 percent slopes, eroded	1,170	0.3
GhE2	Geary silty clay loam, 11 to 17 percent slopes, eroded	1,500	0.4
Gt	Gothenburg sandy loam, 0 to 2 percent slopes	2,250	0.7
Hc	Hastings silt loam, 0 to 1 percent slopes	112,880	31.9
HcB	Hastings silt loam, 1 to 3 percent slopes	12,700	3.6
HdC2	Hastings silty clay loam, 3 to 6 percent slopes, eroded	2,100	0.6
HdD2	Hastings silty clay loam, 6 to 11 percent slopes, eroded	2,300	0.7
He	Hobbs silt loam, 0 to 2 percent slopes	8,200	2.4
Hf	Hobbs silt loam, channeled	5,100	1.5
Hg	Holder silt loam, 0 to 1 percent slopes	38,250	10.9
HgB	Holder silt loam, 1 to 3 percent slopes	12,900	3.7
HgC	Holder silt loam, 3 to 6 percent slopes	7,800	2.2
HgD	Holder silt loam, 6 to 11 percent slopes	1,050	0.3
HhC2	Holder silty clay loam, 3 to 6 percent slopes, eroded	20,500	6.0
HhD2	Holder silty clay loam, 6 to 11 percent slopes, eroded	12,300	3.5
Hk	Holder silt loam, thick surface, 0 to 1 percent slopes	9,400	2.7
Hr	Hord silt loam, 0 to 1 percent slopes	8,900	2.5
HrB	Hord silt loam, 1 to 3 percent slopes	2,600	0.8
HrC	Hord silt loam, 3 to 6 percent slopes	493	0.1
InB	Inavale loamy sand, 0 to 3 percent slopes	920	0.3
Ma	Massie silt loam, 0 to 1 percent slopes	338	0.1
Or	Ortello fine sandy loam, 0 to 1 percent slopes	1,200	0.3
OrB	Ortello fine sandy loam, 1 to 3 percent slopes	1,300	0.4
Ov	Ortello loam, loamy substratum, 0 to 1 percent slopes	560	0.2
OvB	Ortello loam, loamy substratum, 1 to 3 percent slopes	710	0.2
Pb	Pits and Dumps	315	0.1
Pt	Platte loam, 0 to 1 percent slopes	2,000	0.6
Ru	Rusco silt loam, 0 to 1 percent slopes	411	0.1
Sc	Scott silt loam, 0 to 1 percent slopes	483	0.1
Sd	Scott silty clay loam, drained, 0 to 1 percent slopes	1,300	0.4
ThD	Thurman fine sandy loam, 3 to 11 percent slopes	1,400	0.4
ThF	Thurman fine sandy loam, 11 to 30 percent slopes	3,150	0.9
Uy	Uly silt loam, 0 to 1 percent slopes	11,700	3.4
UyB	Uly silt loam, 1 to 3 percent slopes	3,000	0.9
UyC	Uly silt loam, 3 to 6 percent slopes	1,500	0.4
UyE2	Uly silt loam, 11 to 17 percent slopes, eroded	1,150	0.3
UyF	Uly silt loam, 11 to 30 percent slopes	1,750	0.5
	Water areas	2,496	0.7
	Total	349,760	100.0

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability		Corn		Grain sorghum		Winter wheat		Soybeans		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
Ag----------------- Alda	IIIw	IIIw	58	128	68	112	26	---	---	35	2.6	5.2
Bu----------------- Butler	IIw	IIw	44	128	63	108	34	---	---	28	3.0	5.2
CoD2--------------- Coly	IVe	IVe	34	100	46	85	26	---	---	---	2.0	4.5
CoF---------------- Coly	VIe	---	---	---	---	---	---	---	---	---	---	---
CoG---------------- Coly	VIIe	---	---	---	---	---	---	---	---	---	---	---
Cw----------------- Cozad	I	I	56	145	72	110	40	---	---	43	4.6	6.3
CwB---------------- Cozad	IIe	IIe	54	140	70	110	38	---	---	40	4.4	6.0
Cx----------------- Cozad	I	I	60	145	74	110	38	---	---	43	4.8	6.5
Cy----------------- Crete	IIs	IIs	48	135	68	110	40	---	---	30	3.3	5.5
De----------------- Detroit	I	I	52	140	70	110	40	---	---	40	4.1	6.2
Dt----------------- Detroit	I	I	56	145	76	116	44	---	---	45	4.2	6.5
DtB---------------- Detroit	IIe	IIe	48	134	64	108	36	---	---	38	4.0	5.8
Fm----------------- Fillmore	IIIw	IIIw	32	70	48	110	22	---	---	---	2.2	---
Fo----------------- Fillmore	IIw	IIw	46	128	62	104	36	---	---	26	2.8	5.0
Fv----------------- Fonner variant	IVs	IVs	---	70	30	75	18	---	---	---	---	2.8
GeF---------------- Geary	VIe	---	---	---	---	---	---	---	---	---	---	---
GhD2--------------- Geary	IVe	IVe	34	98	42	80	24	---	---	---	2.0	4.2
GhE2--------------- Geary	VIe	---	---	---	---	---	---	---	---	---	---	---
Gt----------------- Gothenburg	VIIs	---	---	---	---	---	---	---	---	---	---	---
Hc----------------- Hastings	I	I	58	145	74	115	42	---	---	46	3.8	6.4
HcB---------------- Hastings	IIe	IIe	56	142	70	112	40	---	---	44	3.6	6.0
HdC2--------------- Hastings	IIIe	IIIe	46	125	57	100	33	---	---	36	2.5	4.5

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability		Corn		Grain sorghum		Winter wheat		Soybeans		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
HdD2 Hastings	IVe	IVe	38	102	45	92	28	---	---	---	2.2	4.5
He Hobbs	IIw	IIw	60	135	72	114	36	---	---	42	3.8	6.3
Hf Hobbs	VIw	---	---	---	---	---	---	---	---	---	---	---
Hg Holder	I	I	60	147	76	115	43	---	---	48	4.2	6.5
HgB Holder	IIe	IIe	58	145	74	113	41	---	---	44	4.0	6.0
HgC Holder	IIIe	IIIe	48	135	64	105	38	---	---	42	3.2	5.2
HgD Holder	IVe	IVe	40	106	52	92	30	---	---	---	2.7	4.8
HhC2 Holder	IIIe	IIIe	44	130	58	100	34	---	---	37	2.8	5.0
HhD2 Holder	IVe	IVe	36	104	52	86	28	---	---	---	2.3	4.5
Hk Holder	I	I	62	150	78	118	44	---	---	48	4.5	6.5
Hr Hord	I	I	62	150	82	118	44	---	---	48	4.8	6.5
HrB Hord	IIe	IIe	60	147	80	116	40	---	---	44	4.6	6.0
HrC Hord	IIIe	IIIe	48	135	60	105	38	---	---	42	3.5	5.5
InB Inavale	IVe	IIIe	28	90	35	80	23	---	---	---	1.8	4.5
Ma Massie	VIIIw	---	---	---	---	---	---	---	---	---	---	---
Or Ortello	IIe	IIe	48	135	58	106	34	---	---	34	3.2	5.4
OrB Ortello	IIIe	IIIe	44	130	52	103	32	---	---	32	3.0	4.8
Ov Ortello	I	I	54	140	70	110	38	---	---	40	4.5	6.3
OvB Ortello	IIe	IIe	50	137	62	108	34	---	---	36	3.4	5.6
Pb*. Pits and Dumps	VIIIs	---	---	---	---	---	---	---	---	---	---	---
Pt Platte	IVw	IVw	35	90	55	85	20	---	---	---	2.0	3.2
Ru Rusco	IIw	I	55	140	68	115	35	---	---	40	3.0	5.8
Sc Scott	IVw	---	---	---	30	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability		Corn		Grain sorghum		Winter wheat		Soybeans		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
Sd----------------- Scott	IIIw	IIIw	25	90	50	95	25	---	---	18	---	---
ThD---------------- Thurman	IVe	IVe	32	105	40	85	24	---	---	---	2.5	4.6
ThF---------------- Thurman	VIe	---	---	---	---	---	---	---	---	---	---	---
Uy----------------- Uly	I	I	56	145	72	114	40	---	---	46	4.2	6.5
UyB---------------- Uly	IIe	IIe	56	143	70	112	38	---	---	42	4.0	6.0
UyC---------------- Uly	IIIe	IIIe	46	128	60	102	36	---	---	40	2.8	5.2
UyE2, UyF---------- Uly	VIe	---	---	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I). Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I (N)	187,364	---	---	---
(I)	187,775	---	---	---
II (N)	77,938	33,927	21,011	23,000
(I)	77,527	33,927	20,600	23,000
III (N)	38,543	33,693	4,850	---
(I)	39,463	34,613	4,850	---
IV (N)	22,366	19,600	2,483	283
(I)	20,963	18,680	2,000	283
V (N)	---	---	---	---
VI (N)	17,600	12,500	5,100	---
VII (N)	2,800	550	---	2,250
VIII(N)	653	---	338	315

TABLE 7.--RANGELAND PRODUCTIVITY

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
Ag: Alda	Subirrigated	5,200	4,900	4,600
Bu: Butler	Clayey	3,800	3,400	3,000
CoD2, CoF: Coly	Limy Upland	3,300	3,000	2,700
CoG: Coly	Thin Loess	2,800	2,600	2,400
Cw, CwB, Cx: Cozad	Silty Lowland	4,500	4,200	3,800
Cy: Crete	Clayey	3,800	3,400	3,000
De: Detroit	Silty Lowland	4,500	4,200	3,800
Dt, DtB: Detroit	Silty Lowland	4,500	4,200	3,800
Fm: Fillmore	Clayey Overflow	3,200	2,700	2,200
Fo: Fillmore	Clayey	3,400	3,000	2,600
Fv: Fonner variant	Sandy Lowland	3,500	3,200	3,000
GeF, GhD2, GhE2: Geary	Silty	4,000	3,600	3,300
Hc, HcB, HdC2, HdD2: Hastings	Silty	4,000	3,600	3,300
He: Hobbs	Silty Overflow	5,000	4,250	3,500
Hf: Hobbs	Silty Overflow	4,500	3,750	3,000
Hg, HgB, HgC, HgD, HhC2, HhD2, Hk: Holder	Silty	4,000	3,600	3,300
Hr, HrB: Hord	Silty Lowland	4,500	4,200	3,800
HrC: Hord	Silty	4,000	3,600	3,300
InB: Inavale	Sandy Lowland	3,300	2,700	2,300
Or, OrB: Ortello	Sandy	3,500	3,300	3,000
Ov, OvB: Ortello	Silty	3,700	3,400	3,200
Pt: Platte	Subirrigated	5,000	4,600	4,200

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
Ru------------------------ Rusco	Silty Lowland--------------------------	4,000	3,500	3,000
Sd------------------------ Scott	Clayey Overflow------------------------	2,800	2,200	1,700
ThD, ThF------------------ Thurman	Sandy----------------------------------	3,500	3,300	3,000
Uy, UyB, UyC, UyE2, UyF-- Uly	Silty----------------------------------	3,700	3,200	2,700

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ag----------------- Alda	Fragrant sumac----	Common chokecherry, American plum.	Eastern redcedar, hackberry, Russian mulberry, Manchurian crabapple.	Siberian elm, green ash, honeylocust, golden willow.	Eastern cottonwood.
Bu----------------- Butler	Redosier dogwood	Common chokecherry, American plum.	Eastern redcedar, ponderosa pine, hackberry, blue spruce.	Golden willow, green ash, honeylocust, silver maple.	Eastern cottonwood.
CoD2--------------- Coly	Silver buffaloberry, fragrant sumac, Siberian peashrub, Tatarian honeysuckle.	Eastern redcedar, Rocky Mountain juniper, bur oak, Russian-olive.	Green ash, ponderosa pine, honeylocust, Siberian elm.	---	---
CoF, CoG. Coly					
Cw, CwB, Cx-------- Cozad	American plum-----	Lilac, Amur honeysuckle.	Eastern redcedar, Austrian pine, Russian-olive, ponderosa pine, green ash, Russian mulberry.	Hackberry, honeylocust.	Eastern cottonwood.
Cy----------------- Crete	Lilac, Peking cotoneaster.	Manchurian crabapple, Amur honeysuckle, Siberian peashrub.	Eastern redcedar, hackberry, Russian-olive, green ash, Austrian pine.	Honeylocust, Siberian elm.	---
De, Dt, DtB-------- Detroit	American plum-----	Amur honeysuckle, lilac.	Eastern redcedar, Austrian pine, Russian-olive, ponderosa pine, green ash, Russian mulberry.	Hackberry, honeylocust.	Eastern cottonwood.
Fm----------------- Fillmore	Redosier dogwood	Common chokecherry, American plum.	Eastern redcedar, hackberry, Russian mulberry.	Austrian pine, green ash, honeylocust, silver maple, golden willow.	Eastern cottonwood.
Fo----------------- Fillmore	Lilac, Peking cotoneaster.	Siberian peashrub, Manchurian crabapple, Amur honeysuckle.	Eastern redcedar, hackberry, Russian-olive, Austrian pine, green ash.	Honeylocust, Siberian elm.	---
Fv----------------- Fonner variant	American plum, redosier dogwood.	Common chokecherry	Eastern redcedar, Austrian pine, Russian mulberry, green ash, hackberry.	Golden willow, honeylocust, silver maple.	Eastern cottonwood.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
GeF. Geary					
GhD2, GhE2 Geary	Peking cotoneaster, fragrant sumac.	Lilac, fragrant sumac, Amur honeysuckle.	Eastern redcedar, hackberry, bur oak, green ash, Russian-olive.	Scotch pine, Austrian pine, honeylocust.	---
Gt. Gothenburg					
Hc, HcB, HdC2, HdD2 Hastings	Amur honeysuckle, lilac, fragrant sumac.	Russian mulberry	Eastern redcedar, Austrian pine, green ash, honeylocust, hackberry, bur oak, Russian-olive.	Siberian elm	---
He Hobbs	---	American plum, Peking cotoneaster, lilac, Amur honeysuckle.	Eastern redcedar, Russian mulberry.	Green ash, hackberry, Austrian pine, honeylocust, bur oak.	Eastern cottonwood.
Hf. Hobbs					
Hg, HgB, HgC, HgD, HhC2, HhD2, Hk Holder	Amur honeysuckle, lilac, fragrant sumac.	Russian mulberry	Eastern redcedar, Austrian pine, green ash, honeylocust, hackberry, bur oak, Russian-olive.	Siberian elm	---
Hr, HrB Hord	Peking cotoneaster	Lilac, Siberian peashrub, American plum.	Eastern redcedar, ponderosa pine, blue spruce, Manchurian crabapple.	Golden willow, green ash, hackberry.	Eastern cottonwood.
HrC Hord	---	Siberian peashrub, American plum lilac.	Ponderosa pine, hackberry, blue spruce, bur oak, Russian-olive, eastern redcedar.	Green ash, honeylocust, Siberian elm.	---
InB Inavale	American plum	Amur honeysuckle, lilac, fragrant sumac.	Eastern redcedar, Russian mulberry, Russian-olive.	Honeylocust, Austrian pine, hackberry, Scotch pine, green ash.	---
Ma. Massie					
Or, OrB Ortello	Skunkbush sumac	American plum, Siberian peashrub, Tatarian honeysuckle, lilac.	Eastern redcedar, honeylocust, ponderosa pine, Russian-olive, hackberry, green ash.	Siberian elm	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ov, OvB: Ortello	---	American plum, Amur honeysuckle, common chokecherry.	Eastern redcedar, ponderosa pine, Austrian pine, Russian mulberry, green ash, hackberry, bur oak.	Honeylocust, Siberian elm.	---
Pb*. Pits and Dumps					
Pt: Platte	Fragrant sumac	American plum, common chokecherry.	Eastern redcedar, hackberry, Russian mulberry, Manchurian crabapple.	Siberian elm, green ash, honeylocust, golden willow.	Eastern cottonwood.
Ru: Rusco	Amur honeysuckle, lilac, fragrant sumac.	Russian mulberry	Eastern redcedar, Austrian pine, green ash, honeylocust, hackberry, bur oak, Russian-olive.	Siberian elm	---
Sc. Scott					
Sd: Scott	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, Austrian pine, hackberry, Russian mulberry.	Golden willow, honeylocust, green ash, silver maple.	Eastern cottonwood.
ThD: Thurman	Lilac, American plum.	Eastern redcedar, Rocky Mountain juniper.	Austrian pine, ponderosa pine, honeylocust, hackberry, green ash, Russian mulberry.	Siberian elm	---
ThF. Thurman					
Uy, UyB, UyC, UyE2: Uly	Amur honeysuckle, lilac.	Common chokecherry, Russian mulberry.	Eastern redcedar, green ash, Russian-olive, honeylocust, Austrian pine, hackberry, bur oak.	Siberian elm	---
UyF. Uly					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ag: Alda	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight	Moderate: flooding.
Bu: Butler	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
CoD2: Coly	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
CoF: Coly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
CoG: Coly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Cw: Cozad	Severe: flooding.	Slight	Slight	Slight	Slight.
CwB: Cozad	Severe: flooding.	Slight	Moderate: slope.	Slight	Slight.
Cx: Cozad	Severe: flooding.	Slight	Slight	Slight	Slight.
Cy: Crete	Slight	Slight	Slight	Slight	Slight.
De: Detroit	Slight	Slight	Slight	Slight	Slight.
Dt: Detroit	Severe: flooding.	Slight	Slight	Slight	Slight.
DtB: Detroit	Slight	Slight	Slight	Slight	Slight.
Fm: Fillmore	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
Fo: Fillmore	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
Fv: Fonner variant	Severe: flooding.	Slight	Slight	Slight	Moderate: droughty.
GeF: Geary	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
GhD2, GhE2: Geary	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Gt: Gothenburg	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty, flooding.
Hc: Hastings	Slight	Slight	Slight	Slight	Slight.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
HcB, HdC2------------- Hastings	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
HdD2------------------ Hastings	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
He-------------------- Hobbs	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
Hf-------------------- Hobbs	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Hg-------------------- Holder	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
HgB, HgC-------------- Holder	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
HgD------------------- Holder	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
HhC2------------------ Holder	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
HhD2------------------ Holder	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
Hk-------------------- Holder	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
Hr-------------------- Hord	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
HrB, HrC-------------- Hord	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
InB------------------- Inavale	Severe: flooding.	Slight----------	Slight----------	Slight----------	Moderate: droughty.
Ma-------------------- Massie	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
Or-------------------- Ortello	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
OrB------------------- Ortello	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Ov-------------------- Ortello	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
OvB------------------- Ortello	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Pb*. Pits and Dumps					
Pt-------------------- Platte	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty, flooding.
Ru-------------------- Rusco	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Sc, Sd----------------- Scott	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
ThD-------------------- Thurman	Slight----------	Slight----------	Severe: slope.	Slight----------	Moderate: droughty.
ThF-------------------- Thurman	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Uy--------------------- Uly	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
UyB, UyC--------------- Uly	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
UyE2------------------- Uly	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
UyF-------------------- Uly	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ag: Alda	Fair	Good	Good	Good	Fair	Good	Fair	Fair	Fair	Good	Fair	Fair.
Bu: Butler	Good	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	Good.
CoD2: Coly	Fair	Good	Good	Fair	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.	Good.
CoF: Coly	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
CoG: Coly	Very poor.	Very poor.	Poor	Poor	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Cw, CwB: Cozad	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Cx: Cozad	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Very poor.	Good.
Cy: Crete	Good	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
De, Dt, DtB: Detroit	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Fm: Fillmore	Fair	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Good	Fair.
Fo: Fillmore	Good	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Fair	Good.
Fv: Fonner variant	Poor	Poor	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Poor.
GeF: Geary	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
GhD2: Geary	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
GhE2: Geary	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Gt: Gothenburg	Very poor.	Very poor.	Fair	Poor	Fair	Fair	Fair	Good	Very poor.	Poor	Fair	Fair.
Hc, HcB: Hastings	Good	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Very poor.	Good.
HdC2, HdD2: Hastings	Fair	Good	Good	Good	Fair	Good	Very poor.	Poor	Good	Good	Very poor.	Good.
He: Hobbs	Good	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Very poor.	Good.
Hf: Hobbs	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Hg, HgB: Holder	Good	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
HgC, HgD, HhC2, HhD2: Holder	Fair	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Hk: Holder	Good	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Hr, HrB: Hord	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
HrC: Hord	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
InB: Inavale	Fair	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Ma: Massie	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
Or, OrB: Ortello	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Ov, OvB: Ortello	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Pb*. Pits and Dumps												
Pt: Platte	Fair	Good	Fair	Poor	Fair	Good	Fair	Good	Fair	Poor	Good	Fair.
Ru: Rusco	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Fair.
Sc: Scott	Poor	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	Fair.
Sd: Scott	Fair	Good	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
ThD, ThF: Thurman	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Uy, UyB: Uly	Good	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
UyC: Uly	Fair	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
UyE2, UyF: Uly	Poor	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ag: Alda	Severe: wetness, cutbanks cave.	Severe: flooding.	Severe: wetness, flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Bu: Butler	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, frost action.	Severe: wetness.
CoD2: Coly	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
CoF, CoG: Coly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cw, CwB: Cozad	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
Cx: Cozad	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
Cy: Crete	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
De: Detroit	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Dt: Detroit	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Slight.
DtB: Detroit	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Fm: Fillmore	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, low strength, frost action.	Severe: ponding.
Fo: Fillmore	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
Fv: Fonner variant	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
GeF: Geary	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
GhD2, GhE2: Geary	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Gt: Gothenburg	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, droughty, flooding.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Hc, HcB, HdC2----- Hastings	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
HdD2-------------- Hastings	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
He---------------- Hobbs	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Hf---------------- Hobbs	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
Hg, HgB----------- Holder	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
HgC--------------- Holder	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
HgD--------------- Holder	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
HhC2-------------- Holder	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
HhD2-------------- Holder	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
Hk---------------- Holder	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
Hr---------------- Hord	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
HrB--------------- Hord	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
HrC--------------- Hord	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: low strength.	Slight.
InB--------------- Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
Ma---------------- Massie	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
Or, OrB----------- Ortello	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
Ov, OvB----------- Ortello	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
Pb*. Pits and Dumps						
Pt---------------- Platte	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, droughty, flooding.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ru----------------- Rusco	Moderate: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: frost action.	Slight.
Sc, Sd------------- Scott	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
ThD---------------- Thurman	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty.
ThF---------------- Thurman	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Uy, UyB------------ Uly	Slight----------	Slight----------	Slight----------	Slight----------	Severe: low strength.	Slight.
UyC---------------- Uly	Slight----------	Slight----------	Slight----------	Moderate: slope.	Severe: low strength.	Slight.
UyE2--------------- Uly	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
UyF---------------- Uly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ag------------------- Alda	Severe: flooding, wetness, poor filter.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Poor: too sandy, seepage.
Bu------------------- Butler	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
CoD2----------------- Coly	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
CoF, CoG------------- Coly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Cw, CwB-------------- Cozad	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
Cx------------------- Cozad	Moderate: flooding, wetness.	Severe: seepage.	Severe: seepage, wetness.	Moderate: flooding, wetness.	Fair: too clayey, thin layer.
Cy------------------- Crete	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Poor: hard to pack.
De------------------- Detroit	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
Dt------------------- Detroit	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
DtB------------------ Detroit	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
Fm------------------- Fillmore	Severe: percs slowly, ponding.	Severe: ponding.	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Fo------------------- Fillmore	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Fv------------------- Fonner variant	Severe: wetness, flooding, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
GeF, GhE2------------ Geary	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
GhD2----------------- Geary	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Gt------------------- Gothenburg	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Hc------------------ Hastings	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
HcB, HdC2----------- Hastings	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
HdD2---------------- Hastings	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
He, Hf-------------- Hobbs	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Hg------------------ Holder	Slight-----------	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
HgB, HgC------------ Holder	Slight-----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
HgD----------------- Holder	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
HhC2---------------- Holder	Slight-----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
HhD2---------------- Holder	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
Hk------------------ Holder	Slight-----------	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
Hr------------------ Hord	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
HrB, HrC------------ Hord	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
InB----------------- Inavale	Severe: poor filter.	Severe: seepage, flooding.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Ma------------------ Massie	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Or, OrB------------- Ortello	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Ov, OvB------------- Ortello	Moderate: percs slowly.	Severe: seepage.	Slight-----------	Severe: seepage.	Good.
Pb*. Pits and Dumps					
Pt------------------ Platte	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ru------------------ Rusco	Severe: flooding, wetness.	Severe: wetness.	Moderate: flooding, wetness.	Moderate: flooding, wetness.	Fair: wetness.
Sc, Sd-------------- Scott	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
ThD----------------- Thurman	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
ThF----------------- Thurman	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: too sandy, seepage, slope.	Severe: seepage, slope.	Poor: slope, too sandy, seepage.
Uy------------------ Uly	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.
UyB, UyC------------ Uly	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
UyE2---------------- Uly	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
UyF----------------- Uly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ag: Alda	Fair: wetness.	Probable	Probable	Poor: area reclaim.
Bu: Butler	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
CoD2: Coly	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
CoF: Coly	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
CoG: Coly	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Cw, CwB: Cozad	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Cx: Cozad	Good	Probable	Improbable: too sandy.	Good.
Cy: Crete	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
De, Dt, DtB: Detroit	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Fm: Fillmore	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
Fo: Fillmore	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Fv: Fonner variant	Good	Probable	Probable	Poor: area reclaim, small stones.
GeF: Geary	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
GhD2, GhE2: Geary	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Gt: Gothenburg	Poor: wetness.	Probable	Probable	Poor: area reclaim, small stones.
Hc, HcB, HdC2, HdD2: Hastings	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
He, Hf: Hobbs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hg, HgB, HgC: Holder	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
HgD: Holder	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
HhC2: Holder	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HhD2 Holder	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
Hk Holder	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hr, HrB, HrC Hord	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
InB Inavale	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Ma Massie	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Or, OrB Ortello	Good	Probable	Improbable: too sandy.	Fair: thin layer.
Ov, OvB Ortello	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Pb*. Pits and Dumps				
Pt Platte	Fair: wetness.	Probable	Probable	Poor: area reclaim, small stones.
Ru Rusco	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Sc, Sd Scott	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
ThD Thurman	Good	Probable	Improbable: too sandy.	Poor: area reclaim.
ThF Thurman	Fair: slope.	Probable	Improbable: too sandy.	Poor: area reclaim, slope.
Uy, UyB, UyC Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
UyE2 Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
UyF Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ag: Alda	Severe: seepage.	Severe: seepage, piping.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Favorable.
Bu: Butler	Moderate: seepage.	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
CoD2, CoF, CoG: Coly	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Cw, CwB: Cozad	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Cx: Cozad	Moderate: seepage.	Severe: thin layer.	Deep to water	Favorable	Erodes easily	Erodes easily.
Cy: Crete	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Percs slowly, erodes easily.	Erodes easily	Erodes easily, percs slowly.
De, Dt, DtB: Detroit	Slight	Moderate: hard to pack.	Deep to water	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Fm: Fillmore	Moderate: seepage.	Severe: hard to pack, ponding.	Percs slowly, frost action, ponding.	Percs slowly, ponding, erodes easily.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
Fo: Fillmore	Moderate: seepage.	Severe: hard to pack.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Fv: Fonner variant	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, fast intake.	Too sandy	Droughty.
GeF, GhD2, GhE2: Geary	Severe: slope.	Slight	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Gt: Gothenburg	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty, rooting depth.
Hc, HcB: Hastings	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable	Erodes easily	Erodes easily.
HdC2: Hastings	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope	Erodes easily	Erodes easily.
HdD2: Hastings	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
He, Hf: Hobbs	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
Hg, HgB: Holder	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
HgC: Holder	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
HgD: Holder	Severe: slope.	Severe: piping.	Deep to water	Slope	Erodes easily, slope.	Slope, erodes easily.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
HhC2: Holder	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
HhD2: Holder	Severe: slope.	Severe: piping.	Deep to water	Slope	Erodes easily, slope.	Slope, erodes easily.
Hk: Holder	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Hr, HrB: Hord	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
HrC: Hord	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
InB: Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Ma: Massie	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, percs slowly.
Or, OrB: Ortello	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable	Too sandy, soil blowing.	Favorable.
Ov, OvB: Ortello	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
Pb*. Pits and Dumps						
Pt: Platte	Severe: seepage.	Severe: seepage, wetness, piping.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
Ru: Rusco	Moderate: seepage.	Severe: piping.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
Sc, Sd: Scott	Moderate: seepage.	Severe: hard to pack, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Not needed	Not needed.
ThD: Thurman	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing, droughty, slope.	Too sandy, soil blowing.	Droughty.
ThF: Thurman	Severe: slope, seepage.	Severe: seepage, piping.	Deep to water	Soil blowing, droughty, slope.	Slope, too sandy, soil blowing.	Droughty, slope.
Uy, UyB: Uly	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
UyC: Uly	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
UyE2, UyF: Uly	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ag: Alda	0-11	Loam	ML, CL-ML, CL	A-4	0	90-100	85-100	85-100	50-75	20-35	3-10
	11-22	Fine sandy loam, sandy loam, very fine sandy loam.	SM, SM-SC	A-2, A-4	0	95-100	95-100	70-100	30-50	<26	NP-7
	22-60	Coarse sand, gravelly sand.	SP, SM, SP-SM	A-1, A-2, A-3	0	70-100	65-95	30-95	2-15	<20	NP
Bu: Butler	0-11	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	20-40	5-15
	11-32	Clay, silty clay	CH	A-7	0	100	100	100	95-100	50-70	30-45
	32-60	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	100	95-100	35-60	15-35
CoD2, CoF, CoG: Coly	0-5	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	85-100	20-40	2-15
	5-60	Silt loam, very fine sandy loam, loam.	ML, CL, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
Cw, CwB: Cozad	0-7	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	100	75-100	20-35	2-12
	7-60	Silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-95	20-35	2-12
Cx: Cozad	0-10	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-35	2-15
	10-15	Loam, silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-35	2-15
	15-60	Silty clay loam, loam.	CL	A-6	0	100	100	95-100	90-100	25-40	12-25
Cy: Crete	0-11	Silt loam	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	11-30	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-65	25-40
	30-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	30-55	13-35
De, Dt: Detroit	0-18	Silt loam	CL	A-6, A-4	0	100	100	95-100	85-95	25-40	8-20
	18-38	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	90-100	50-60	25-35
	38-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	25-45	10-25
DtB: Detroit	0-18	Silt loam	CL	A-6, A-4	0	100	100	95-100	85-95	25-40	8-20
	18-38	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	90-100	50-60	25-35
	38-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	25-45	10-25
Fm: Fillmore	0-12	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-40	2-20
	12-40	Silty clay, clay	CH, CL	A-7	0	100	100	100	95-100	40-75	20-45
	40-52	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-60	20-40
	52-60	Silt loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	100	95-100	25-75	10-45
Fo: Fillmore	0-16	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-40	2-20
	16-34	Silty clay	CH	A-7	0	100	100	100	95-100	50-75	30-45
	34-40	Silty clay loam, silty clay.	CL, CH	A-7, A-6	0	100	100	100	95-100	35-60	20-40
	40-60	Silt loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	100	95-100	25-75	10-45

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Fv---------------- Fonner variant	0-6	Loamy sand-------	SM, SP-SM	A-2, A-3	0	100	95-100	80-95	5-30	<20	NP
	6-19	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM	A-2, A-3	0	95-100	90-100	70-85	5-15	<20	NP
	19-60	Gravelly sand, coarse sand.	SP, SP-SM	A-1	0	70-95	55-80	30-50	1-7	<20	NP
GeF--------------- Geary	0-7	Silt loam--------	ML, CL	A-4, A-6	0	100	100	96-100	80-98	25-40	2-15
	7-24	Silty clay loam, clay loam.	CL	A-7, A-6	0	100	100	96-100	85-98	35-50	15-25
	24-60	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0	100	100	96-100	85-98	30-45	11-22
GhD2, GhE2------- Geary	0-5	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	75-98	35-45	15-25
	5-27	Silty clay loam, clay loam.	CL	A-7, A-6	0	100	100	96-100	85-98	35-50	15-25
	27-60	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0	100	100	96-100	85-98	30-45	11-22
Gt---------------- Gothenburg	0-3	Sandy loam-------	CL-ML, ML, SM, SM-SC	A-2, A-4	0	100	100	60-100	30-90	20-35	2-10
	3-9	Fine sand, sand, gravelly sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	65-80	0-15	---	NP
	9-60	Sand and gravel	SP, SM, SP-SM	A-1, A-2, A-3	0	70-95	65-95	30-65	3-15	---	NP
Hc, HcB---------- Hastings	0-6	Silt loam--------	CL, ML	A-6, A-4	0	100	100	100	95-100	28-40	8-18
	6-28	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	42-65	22-40
	28-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	30-48	11-25
HdC2-------------- Hastings	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	30-45	11-22
	8-13	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	42-60	22-40
	13-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	30-48	11-25
HdD2-------------- Hastings	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	30-45	11-22
	6-12	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	42-60	22-40
	12-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	30-48	11-25
He, Hf----------- Hobbs	0-20	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	20-60	Silt loam, silty clay loam.	CL, CL-ML, MH	A-4, A-6, A-7	0	100	100	95-100	80-100	25-55	5-25
Hg, HgB, HgC, HgD-------------- Holder	0-10	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	98-100	90-100	20-40	2-16
	10-29	Silty clay loam	CL	A-6, A-7	0	100	100	98-100	95-100	35-50	20-35
	29-60	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
HhC2, HhD2------- Holder	0-6	Silty clay loam	CL	A-7, A-6	0	100	100	98-100	95-100	35-50	20-35
	6-60	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
Hk---------------- Holder	0-25	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	98-100	90-100	20-40	2-16
	25-50	Silty clay loam	CL	A-6, A-7	0	100	100	98-100	95-100	35-50	20-35
	50-60	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Hr, HrB---------- Hord	0-14	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-35	3-18
	14-42	Silt loam, silty clay loam, loam.	CL	A-6, A-4	0	100	100	98-100	85-100	25-40	8-23
	42-60	Silt loam, very fine sandy loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	100	85-100	25-40	6-21
HrC-------------- Hord	0-10	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-35	3-18
	10-24	Silt loam, silty clay loam, loam.	CL	A-6, A-4	0	100	100	98-100	85-100	25-40	8-23
	24-60	Silt loam, very fine sandy loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	100	85-100	25-40	6-21
InB-------------- Inavale	0-7	Loamy sand-------	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	85-95	5-35	<25	NP-5
	7-42	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	42-60	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	100	70-90	5-30	<25	NP-5
Ma--------------- Massie	0-4	Silt loam--------	CL	A-4, A-6, A-7	0	100	100	100	95-100	22-45	8-25
	4-60	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	100	95-100	45-70	20-45
Or, OrB---------- Ortello	0-12	Fine sandy loam	SM, ML	A-4	0	100	100	70-95	40-55	<20	NP
	12-40	Fine sandy loam, sandy loam.	SM, ML	A-4	0	100	100	70-95	40-55	<20	NP
	40-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM	A-3, A-2	0	100	100	50-70	5-35	---	NP
Ov, OvB---------- Ortello	0-11	Loam-------------	ML, CL, CL-ML	A-4	0	100	100	85-100	65-95	20-35	2-10
	11-38	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-4	0	100	100	70-85	35-55	<25	NP-5
	38-60	Silt loam, loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-40	4-20
Pb*. Pits and Dumps											
Pt--------------- Platte	0-7	Loam-------------	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	60-95	22-35	4-15
	7-12	Very fine sandy loam, loam, fine sandy loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	95-100	75-95	45-75	<20	NP-5
	12-60	Gravelly coarse sand, coarse sand, gravelly sand.	SP-SM, SM	A-1, A-2, A-3	0	70-95	50-95	25-65	5-15	<20	NP
Ru--------------- Rusco	0-14	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	85-100	60-100	20-40	3-15
	14-22	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	30-45	15-30
	22-60	Loam, very fine sandy loam, silt loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	70-100	20-35	3-15
Sc--------------- Scott	0-7	Silt loam--------	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	100	95-100	20-45	2-20
	7-34	Silty clay, clay	CH, CL	A-7	0	100	100	100	95-100	41-75	20-45
	34-43	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-60	20-40
	43-60	Silt loam, silty clay loam, clay loam.	CL	A-4, A-6, A-7	0	100	100	90-100	90-100	25-50	8-24

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Sd----------------- Scott	0-4	Silty clay loam	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	100	95-100	20-45	2-20
	4-38	Silty clay, clay	CH, CL	A-7	0	100	100	100	95-100	41-75	20-45
	38-60	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-60	20-40
ThD, ThF--------- Thurman	0-16	Fine sandy loam	SM	A-4	0	100	100	70-100	35-50	<20	NP
	16-60	Loamy fine sand, fine sand, very fine sand.	SM, SP-SM	A-2, A-3	0	100	100	85-100	5-25	---	NP
Uy, UyB, UyC, UyE2, UyF-------- Uly	0-7	Silt loam--------	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	2-15
	7-17	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-15
	17-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	3-15

* See description of the map unit for composition and behavior characteristics of the map units.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	mmhos/cm					Pct
Ag, Alda	0-11	12-25	1.40-1.60	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low	0.28	4	6	2-4
	11-22	3-10	1.70-1.90	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low	0.20			
	22-60	0-2	1.50-1.70	>20	0.02-0.04	6.6-8.4	<2	Low	0.10			
Bu, Butler	0-11	18-35	1.20-1.40	0.6-2.0	0.20-0.22	5.1-7.3	<2	Moderate	0.37	4	6	2-4
	11-32	45-55	1.10-1.20	0.06-0.2	0.11-0.13	5.6-8.4	<2	High	0.37			
	32-60	32-45	1.10-1.30	0.2-0.6	0.14-0.20	6.6-8.4	<2	High	0.37			
CoD2, CoF, CoG, Coly	0-5	18-24	1.30-1.50	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low	0.43	5	6	.5-1
	5-60	18-24	1.30-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.43			
Cw, CwB, Cozad	0-7	11-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.3	<2	Low	0.32	5	6	1-2
	7-60	14-18	1.30-1.40	0.6-2.0	0.17-0.19	6.1-8.4	<2	Low	0.43			
Cx, Cozad	0-10	10-20	1.20-1.30	0.6-2.0	0.20-0.22	6.6-7.3	<2	Low	0.32	5	5	2-4
	10-15	8-18	1.20-1.30	0.6-2.0	0.17-0.22	6.6-7.3	<2	Low	0.43			
	15-60	16-27	1.20-1.30	0.6-2.0	0.15-0.20	7.9-8.4	<2	Moderate	0.32			
Cy, Crete	0-11	20-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-6.0	<2	Moderate	0.37	4	6	2-4
	11-30	42-52	1.10-1.30	0.06-0.6	0.12-0.20	6.1-7.3	<2	High	0.37			
	30-60	25-40	1.20-1.40	0.2-2.0	0.18-0.22	7.4-8.4	<2	High	0.37			
De, Dt, Detroit	0-18	22-27	1.25-1.40	0.2-0.6	0.22-0.24	6.1-7.3	<2	Low	0.37	5	6	2-4
	18-38	35-45	1.35-1.50	0.06-0.2	0.12-0.18	6.6-7.8	<2	High	0.37			
	38-60	18-35	1.30-1.50	0.2-0.6	0.18-0.22	6.6-8.4	<2	Moderate	0.37			
DtB, Detroit	0-18	22-27	1.25-1.40	0.2-0.6	0.22-0.24	6.1-7.3	<2	Low	0.37	5	6	2-4
	18-38	35-45	1.35-1.50	0.06-0.2	0.12-0.18	6.6-7.8	<2	High	0.37			
	38-60	18-35	1.30-1.50	0.2-0.6	0.18-0.22	6.6-8.4	<2	Moderate	0.37			
Fm, Fillmore	0-12	18-35	1.30-1.40	0.6-2.0	0.21-0.24	5.6-6.5	<2	Moderate	0.37	4	6	2-4
	12-40	40-55	1.30-1.50	<0.06	0.11-0.14	5.6-7.8	<2	High	0.37			
	40-52	32-40	1.20-1.40	0.2-0.6	0.18-0.20	6.6-8.4	<2	High	0.37			
	52-60	18-45	1.30-1.50	0.06-2.0	0.10-0.22	6.6-8.4	<2	Moderate	0.37			
Fo, Fillmore	0-16	20-35	1.30-1.40	0.6-2.0	0.22-0.24	5.6-6.5	<2	Moderate	0.37	4	6	2-4
	16-34	40-55	1.30-1.50	<0.06	0.11-0.13	5.6-7.8	<2	High	0.37			
	34-40	35-50	1.30-1.50	0.2-0.6	0.18-0.20	6.6-7.8	<2	High	0.37			
	40-60	24-45	1.30-1.40	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.37			
Fv, Fonner variant	0-6	2-7	1.60-1.80	6.0-20.0	0.10-0.12	6.1-7.3	<2	Low	0.17	2	2	.5-1
	6-19	2-7	1.60-1.80	6.0-20.0	0.09-0.11	6.1-7.3	<2	Low	0.17			
	19-60	0-3	1.70-1.95	>20.0	0.02-0.04	6.1-7.3	<2	Low	0.10			
GeF, Geary	0-7	15-27	1.30-1.40	0.6-2.0	0.22-0.24	5.6-6.5	<2	Low	0.32	5	6	2-4
	7-24	27-35	1.35-1.50	0.2-0.6	0.17-0.20	5.6-7.8	<2	Moderate	0.43			
	24-60	20-32	1.30-1.40	0.6-2.0	0.15-0.19	6.1-8.4	<2	Moderate	0.43			
GhD2, GhE2, Geary	0-5	27-35	1.30-1.40	0.2-0.6	0.18-0.23	5.6-6.5	<2	Moderate	0.32	5	6	1-2
	5-27	27-35	1.35-1.50	0.2-0.6	0.17-0.20	5.6-7.8	<2	Moderate	0.43			
	27-60	20-32	1.30-1.40	0.6-2.0	0.15-0.19	6.1-8.4	<2	Moderate	0.43			
Gt, Gothenburg	0-3	5-12	1.40-1.50	2.0-6.0	0.13-0.22	6.6-8.4	<2	Low	0.24	2	3	<.05
	3-9	1-5	1.50-1.70	6.0-20	0.06-0.08	6.6-8.4	<2	Low	0.17			
	9-60	0-2	1.70-1.90	>20	0.02-0.04	6.6-8.4	<2	Low	0.10			
Hc, HcB, Hastings	0-6	18-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-6.5	<2	Moderate	0.32	5	6	2-4
	6-28	35-42	1.30-1.40	0.2-0.6	0.11-0.20	5.6-7.3	<2	High	0.43			
	28-60	25-38	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	0.43			
HdC2, Hastings	0-8	28-38	1.20-1.40	0.6-2.0	0.21-0.23	5.6-6.5	<2	Moderate	0.32	5	7	1-2
	8-13	35-40	1.30-1.40	0.2-0.6	0.11-0.20	5.6-7.3	<2	Moderate	0.43			
	13-60	25-38	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	0.43			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	mmhos/cm					Pct
HdD2--------------	0-6	28-38	1.20-1.40	0.6-2.0	0.21-0.23	5.6-6.5	<2	Moderate	0.32	5	7	1-2
Hastings	6-12	35-40	1.30-1.40	0.2-0.6	0.11-0.20	5.6-7.3	<2	Moderate	0.43			
	12-60	25-38	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	0.43			
He, Hf-----------	0-20	15-30	1.20-1.40	0.6-2.0	0.21-0.24	6.1-7.8	<2	Low--------	0.32	5	6	2-4
Hobbs	20-60	15-30	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	<2	Low--------	0.32			
Hg, HgB, HgC, HgD--------------	0-10	18-27	1.40-1.60	0.6-2.0	0.22-0.24	5.1-7.3	<2	Low--------	0.32	5	6	2-4
Holder	10-29	28-35	1.20-1.40	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.43			
	29-60	18-30	1.40-1.60	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			
HhC2, HhD2--------	0-6	28-35	1.30-1.50	0.6-2.0	0.21-0.23	5.1-7.3	<2	Moderate	0.32	5	7	1-2
Holder	6-60	10-30	1.40-1.60	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			
Hk----------------	0-25	15-27	1.40-1.60	0.6-2.0	0.22-0.24	5.1-7.3	<2	Low--------	0.32	5	6	2-4
Holder	25-50	28-35	1.20-1.40	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.43			
	50-60	18-30	1.40-1.60	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			
Hr, HrB-----------	0-14	17-27	1.30-1.40	0.6-2.0	0.20-0-24	5.6-7.3	<2	Low--------	0.32	5	6	2-4
Hord	14-42	20-35	1.35-1.45	0.6-2.0	0.17-0.22	6.1-7.8	<2	Low--------	0.32			
	42-60	18-30	1.30-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
HrC---------------	0-10	17-27	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low--------	0.32	5	6	2-4
Hord	10-24	20-35	1.35-1.45	0.6-2.0	0.17-0.22	6.1-7.8	<2	Low--------	0.32			
	24-60	18-30	1.30-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
InB---------------	0-7	2-10	1.50-1.60	6.0-20	0.10-0.12	6.1-7.8	<2	Low--------	0.17	5	2	.5-1
Inavale	7-42	3-10	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	<2	Low--------	0.17			
	42-60	3-10	1.50-1.60	6.0-20	0.05-0.10	6.6-8.4	<2	Low--------	0.17			
Ma----------------	0-4	15-40	1.40-1.50	0.2-2.0	0.21-0-24	5.1-6.5	<2	Moderate	0.37	3	6	4-8
Massie	4-60	35-55	1.20-1.40	<0.06	0.09-0.20	5.6-7.8	<2	High-------	0.37			
Or, OrB-----------	0-12	5-15	1.40-1.60	2.0-6.0	0.13-0.18	6.1-7.3	<2	Low--------	0.20	5	3	1-2
Ortello	12-40	5-15	1.40-1.60	2.0-6.0	0.12-0.17	6.1-7.3	<2	Low--------	0.20			
	40-60	2-10	1.50-1.70	6.0-20	0.05-0.10	6.6-7.8	<2	Low--------	0.15			
Ov, OvB-----------	0-11	7-20	1.35-1.45	0.6-2.0	0.22-0.24	5.6-6.5	<2	Low--------	0.28	5	3	1-2
Ortello	11-38	8-18	1.50-1.70	2.0-6.0	0.12-0.17	6.1-7.3	<2	Low--------	0.28			
	38-60	7-22	1.35-1.50	0.6-2.0	0.17-0.22	6.1-7.3	<2	Low--------	0.28			
Pb*. Pits and Dumps												
Pt----------------	0-7	10-20	1.50-1.70	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low--------	0.28	2	4L	1-2
Platte	7-12	7-18	1.70-1.90	0.6-2.0	0.15-0.19	6.6-8.4	<2	Low--------	0.28			
	12-60	0-3	1.90-2.00	<20	0.02-0.04	6.6-8.4	<2	Low--------	0.10			
Ru----------------	0-14	17-27	1.30-1.40	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	2-4
Rusco	14-22	28-35	1.20-1.30	0.2-0.6	0.18-0.20	6.6-8.4	<2	Moderate	0.43			
	22-60	15-25	1.40-1.50	0.6-2.0	0.17-0.22	6.6-8.4	<2	Low--------	0.43			
Sc----------------	0-7	15-35	1.25-1.40	0.6-2.0	0.21-0.24	5.6-7.3	<2	Low--------	0.37	3	6	2-4
Scott	7-34	40-55	1.20-1.40	<0.06	0.10-0.14	5.6-7.8	<2	High-------	0.37			
	34-43	27-40	1.15-1.40	0.2-0.6	0.18-0.20	6.6-7.8	<2	High-------	0.37			
	43-60	18-35	1.30-1.50	0.6-2.0	0.14-0.22	6.6-7.8	<2	Moderate	0.37			
Sd-----------------	0-4	15-35	1.25-1.40	0.6-2.0	0.21-0.24	5.6-7.3	<2	Low--------	0.37	3	6	2-4
Scott	4-38	40-55	1.20-1.40	<0.06	0.10-0.14	5.6-7.8	<2	High-------	0.37			
	38-60	27-40	1.15-1.40	0.2-0.6	0.18-0.20	6.6-7.8	<2	High-------	0.37			
ThD, ThF----------	0-16	8-18	1.40-1.60	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low--------	0.17	5	3	1-2
Thurman	16-60	2-10	1.60-1.80	6.0-20	0.06-0.11	6.1-7.3	<2	Low--------	0.17			
Uy, UyB, UyC, UyE2, UyF--------	0-7	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-4
Uly	7-17	20-32	1.20-1.30	0.6-2.0	0.18-0.22	6.1-8.4	<2	Low--------	0.43			
	17-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Ag----------------- Alda	C	Occasional	Brief-----	Apr-Jul	2.0-3.0	Apparent	Nov-May	High-----	Moderate	Low.
Bu----------------- Butler	D	None---------	---	---	0.5-2.0	Perched	Mar-Jul	High-----	High-----	Low.
CoD2, CoF, CoG---- Coly	B	None---------	---	---	>6.0	---	---	Moderate	High-----	Low.
Cw, CwB----------- Cozad	B	Rare---------	---	---	>6.0	---	---	Moderate	Low-------	Low.
Cx----------------- Cozad	B	Rare---------	---	---	4.0-6.0	Apparent	Mar-May	Moderate	Moderate	Low.
Cy----------------- Crete	C	None---------	---	---	>6.0	---	---	Moderate	Moderate	Low.
De----------------- Detroit	C	None---------	---	---	>6.0	---	---	Low-------	High-----	Low.
Dt----------------- Detroit	C	Rare---------	---	---	>6.0	---	---	Low-------	High-----	Low.
DtB---------------- Detroit	C	None---------	---	---	>6.0	---	---	Low-------	High-----	Low.
Fm*---------------- Fillmore	D	None---------	---	---	+.5-1.0	Perched	Mar-Jul	High-----	High-----	Low.
Fo----------------- Fillmore	D	None---------	---	---	1.0-3.0	Perched	Mar-Jul	High-----	High-----	Low.
Fv----------------- Fonner variant	D	Occasional	Brief-----	Mar-Jun	3.0-5.0	Apparent	Mar-May	Low-------	High-----	Moderate.
GeF, GhD2, GhE2--- Geary	B	None---------	---	---	>6.0	---	---	High-----	Low-------	Low.
Gt----------------- Gothenburg	D	Frequent----	Brief-----	Mar-Jun	0-2.0	Apparent	Nov-Jun	Moderate	Moderate	Low.
Hc, HcB, HdC2, HdD2------------- Hastings	B	None---------	---	---	>6.0	---	---	Moderate	Moderate	Low.
He----------------- Hobbs	B	Occasional	Brief-----	Apr-Sep	>6.0	---	---	Moderate	Low-------	Low.
Hf----------------- Hobbs	B	Frequent----	Brief-----	Apr-Sep	>6.0	---	---	Moderate	Low-------	Low.
Hg, HgB, HgC, HgD, HhC2, HhD2, Hk--- Holder	B	None---------	---	---	>6.0	---	---	High-----	Low-------	Low.
Hr----------------- Hord	B	Rare---------	---	---	>6.0	---	---	Moderate	High-----	Low.

See footnotes at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
HrB, HrC---------- Hord	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
InB--------------- Inavale	A	Rare--------	---	---	>6.0	---	---	Low------	Moderate	Low.
Ma*--------------- Massie	D	None--------	---	---	+2-1.0	Perched	Mar-Aug	High-----	High-----	Low.
Or, OrB----------- Ortello	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Low.
Ov, OvB----------- Ortello	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
Pb**. Pits and Dumps										
Pt---------------- Platte	B	Occasional	Brief-----	Mar-Oct	1.0-2.0	Apparent	Feb-Jun	Moderate	High-----	Moderate.
Ru---------------- Rusco	C	Rare--------	---	---	2.0-4.0	Perched	Nov-Jun	High-----	High-----	Low.
Sc, Sd*----------- Scott	D	None--------	---	---	+.5-2.0	Perched	Mar-Aug	High-----	High-----	Low.
ThD, ThF---------- Thurman	A	None--------	---	---	>6.0	---	---	Low------	Low------	Low.
Uy, UyB, UyC, UyE2, UyF-------- Uly	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.

* In the "High water table--Depth" column, a plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX TEST DATA

Soil name*, report number, horizon, and depth in inches	Classification		Grain-size distribution									Liquid limit	Plasticity index	Specific gravity
			Percentage passing sieve--						Percentage smaller than--					
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
												Pct		G/cc
Crete silt loam: (S79NE81-97)														
Ap----- 0 to 5	A-4(8)	ML	100	100	100	100	100	99	90	25	20	30	5	2.57
Bt2---- 14 to 27	A-7-6 (26)	CH	100	100	100	100	100	99	96	52	45	68	40	2.69
C------ 30 to 60	A-6(9)	CL	100	100	100	100	100	99	93	22	14	38	13	2.68
Geary silty clay loam: (S79NE81-96)														
Ap---- 0 to 5	A-6(11)	CL	100	100	100	100	100	97	92	33	28	38	18	2.66
C1---- 5 to 24	A-6(11)	CL	100	100	100	100	100	97	90	30	27	39	18	2.69
C2---- 24 to 60	A-7-6 (12)	CL	100	100	100	100	100	94	84	30	23	41	20	2.69
Hastings silt loam: (S78NE81-7)														
Ap----- 0 to 5	A-4(8)	ML	100	100	100	100	100	97	92	22	15	34	8	2.58
Bt2---- 15 to 25	A-7-6 (25)	CH	100	100	100	100	100	98	94	50	42	67	39	2.68
C1----- 28 to 55	A-7-6 (18)	CH	100	100	100	100	100	99	93	43	36	54	28	2.71
Holder silty clay loam: (S78NE81-8)														
Ap---- 0 to 5	A-7-6 (14)	CL	100	100	100	100	100	99	94	35	27	46	22	2.67
C2---- 20 to 60	A-6(10)	CL	100	100	100	100	100	100	96	22	14	40	15	2.73
Scott silt loam: (S79NE81-95)														
A1----- 0 to 5	A-7-6 (11)	ML	100	100	100	100	100	99	93	38	29	44	16	2.55
Bt2---- 7 to 26	A-7-6 (23)	CH	100	100	100	100	100	99	93	48	43	61	37	2.66
C1----- 43 to 60	A-7-6 (14)	CL	100	100	100	100	100	99	91	37	32	45	23	2.67
Uly silt loam: (S79NE81-54)														
Ap----- 0 to 7	A-6(10)	CL	100	100	100	100	100	99	92	27	21	38	14	2.64
C1----- 7 to 15	A-6(9)	CL	100	100	100	100	100	99	93	24	13	38	13	2.67
C2----- 15 to 40	A-6(8)	ML	100	100	100	100	100	99	93	19	11	36	11	2.70

* Locations of the sampled pedons are as follows--

Crete silt loam: 2,500 feet north and 150 feet west of the southeast corner of sec. 26, T. 10 N., R. 6 W.

Geary silt loam: 300 feet east and 300 feet south of the northwest corner of sec. 27, T. 9 N., R. 5 W.

Hastings silt loam: 200 feet west and 100 feet south of the northeast corner of sec. 28, T. 9 N., R. 7 W.

Holder silt loam: 1,700 feet east and 300 feet south of the northwest corner of sec. 20, T. 9 N., R. 7 W.

Scott silt loam: 1,000 feet south and 200 feet east of the northwest corner of sec. 4, T. 10 N., R. 7 W.

Uly silt loam: 2,400 feet west and 100 feet north of the southeast corner of sec. 6, T. 10 N., R. 8 W.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alda	Coarse-loamy, mixed, mesic Fluvaquentic Haplustolls
Butler	Fine, montmorillonitic, mesic Abruptic Argiaquolls
Coly	Fine-silty, mixed (calcareous), mesic Typic Ustorthents
Cozad	Coarse-silty, mixed, mesic Fluventic Haplustolls
Crete	Fine, montmorillonitic, mesic Pachic Argiustolls
Detroit	Fine, montmorillonitic, mesic Pachic Argiustolls
Fillmore	Fine, montmorillonitic, mesic Typic Argialbolls
Fonner variant	Mixed, mesic Aquic Ustipsamments
Geary	Fine-silty, mixed, mesic Udic Argiustolls
Gothenburg	Mixed, mesic Typic Psammaquents
Hastings	Fine, montmorillonitic, mesic Udic Argiustolls
Hobbs	Fine-silty, mixed, nonacid, mesic Mollic Ustifluvents
Holder	Fine-silty, mixed, mesic Udic Argiustolls
Hord	Fine-silty, mixed, mesic Cumulic Haplustolls
Inavale	Sandy, mixed, mesic Typic Ustifluvents
Massie	Fine, montmorillonitic, mesic Typic Argialbolls
Ortello	Coarse-loamy, mixed, mesic Udic Haplustolls
Platte	Sandy, mixed, mesic Mollic Fluvaquents
Rusco	Fine-silty, mixed, mesic Aquic Argiustolls
Scott	Fine, montmorillonitic, mesic Typic Argialbolls
Thurman	Sandy, mixed, mesic Udorthentic Haplustolls
Uly	Fine-silty, mixed, mesic Typic Haplustolls

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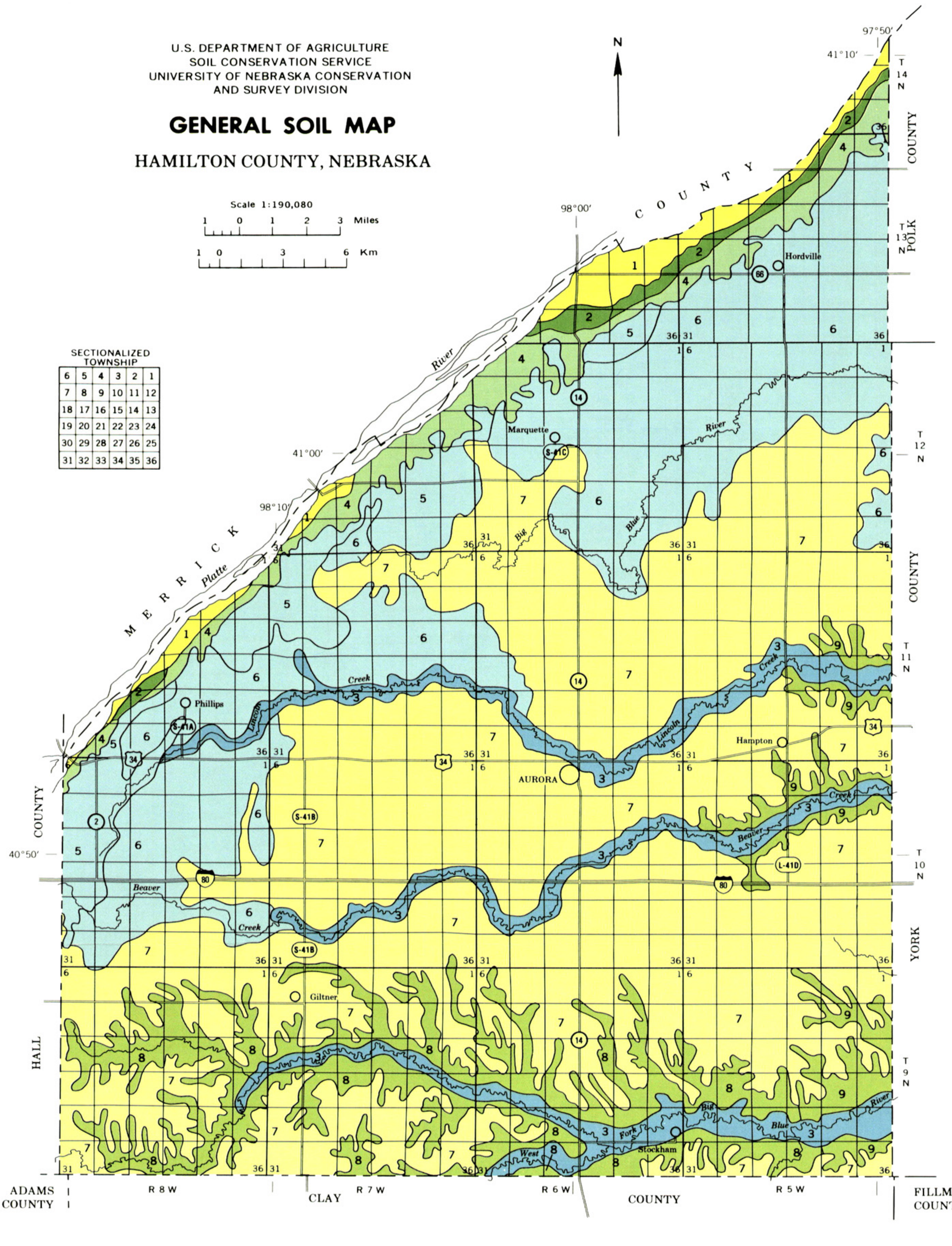
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF NEBRASKA CONSERVATION
AND SURVEY DIVISION

GENERAL SOIL MAP

HAMILTON COUNTY, NEBRASKA

Scale 1:190,080



LEGEND

SOMEWHAT POORLY DRAINED AND POORLY DRAINED, NEARLY LEVEL SOILS ON BOTTOM LANDS

1 — Gothenburg-Platte-Alda association: Nearly level, somewhat poorly drained and poorly drained, loamy soils that are very shallow to moderately deep over sand and gravel and that formed in recent alluvium

WELL DRAINED, NEARLY LEVEL AND VERY GENTLY SLOPING SOILS ON STREAM TERRACES

2 — Ortello-Cozad association: Deep, nearly level and very gently sloping, well drained, loamy and silty soils that formed in alluvium

WELL DRAINED, NEARLY LEVEL TO GENTLY SLOPING SOILS ON STREAM TERRACES AND BOTTOM LANDS

3 — Hord-Hobbs association: Deep, nearly level to gently sloping, well drained, silty soils that formed in alluvium

EXCESSIVELY DRAINED TO WELL DRAINED, GENTLY SLOPING TO VERY STEEP SOILS ON UPLANDS

4 — Thurman-Coly association: Deep, gently sloping to very steep, excessively drained to well drained, loamy and silty soils that formed in loamy and sandy materials or in loess

WELL DRAINED, NEARLY LEVEL TO GENTLY SLOPING SOILS ON UPLANDS

5 — Uly association: Deep, nearly level to gently sloping, well drained, silty soils that formed in loess

6 — Holder association: Deep, nearly level to gently sloping, well drained, silty soils that formed in loess

WELL DRAINED AND MODERATELY WELL DRAINED, NEARLY LEVEL TO GENTLY SLOPING SOILS ON UPLANDS

7 — Hastings-Crete-Holder association: Deep, nearly level to gently sloping, well drained and moderately well drained, silty soils that formed in loess

WELL DRAINED AND SOMEWHAT EXCESSIVELY DRAINED, GENTLY SLOPING TO STEEP SOILS ON UPLANDS

8 — Holder-Geary association: Deep, gently sloping to steep, well drained and somewhat excessively drained, silty soils that formed in loess

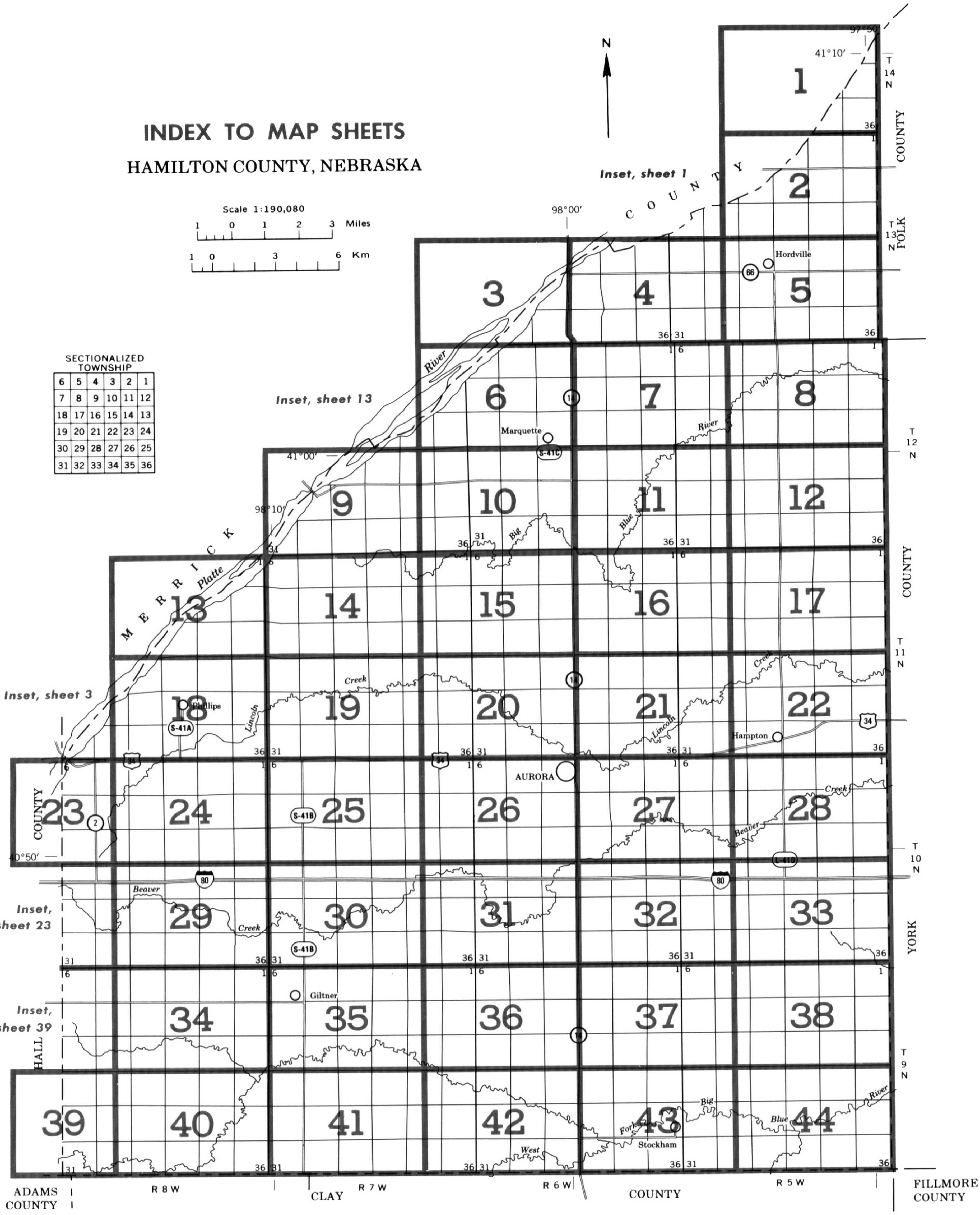
9 — Hastings association: Deep, gently sloping and strongly sloping, well drained, silty soils that formed in loess

* Texture terms in the descriptive headings refer to the texture of the surface layer of the major soils.

Compiled 1983

INDEX TO MAP SHEETS

HAMILTON COUNTY, NEBRASKA



SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lower-case letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroding phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is eroded.

NAME	SYMBOL
Ag	Alda loam, 0 to 2 percent slopes
Bu	Butler silt loam, 0 to 1 percent slopes
CoD2	Coly silt loam, 6 to 11 percent slopes, eroded
CoF	Coly silt loam, 11 to 30 percent slopes
CoG	Coly silt loam, 30 to 60 percent slopes
Cw	Cozad silt loam, 0 to 1 percent slopes
CwB	Cozad silt loam, 1 to 3 percent slopes
Cx	Cozad silt loam, wet substratum, 0 to 1 percent slopes
Cy	Crete silt loam, 0 to 1 percent slopes
De	Detroit silt loam, 0 to 1 percent slopes
Dt	Detroit silt loam, terrace, 0 to 1 percent slopes
DtB	Detroit silt loam, terrace, 1 to 3 percent slopes
Fm	Fillmore silt loam, 0 to 1 percent slopes
Fo	Fillmore silt loam, drained, 0 to 1 percent slopes
Fv	Fonner Variant loamy sand, 0 to 2 percent slopes
GeF	Geary silt loam, 11 to 30 percent slopes
GhD2	Geary silty clay loam, 6 to 11 percent slopes, eroded
GhE2	Geary silty clay loam, 11 to 17 percent slopes, eroded
Gt	Gothenburg sandy loam, 0 to 2 percent slopes
Hc	Hastings silt loam, 0 to 1 percent slopes
HcB	Hastings silt loam, 1 to 3 percent slopes
HdC2	Hastings silty clay loam, 3 to 6 percent slopes, eroded
HdD2	Hastings silty clay loam, 6 to 11 percent slopes, eroded
He	Hobbs silt loam, 0 to 2 percent slopes
Hf	Hobbs silt loam, channeled
Hg	Holder silt loam, 0 to 1 percent slopes
HgB	Holder silt loam, 1 to 3 percent slopes
HgC	Holder silt loam, 3 to 6 percent slopes
HgD	Holder silt loam, 6 to 11 percent slopes
HhC2	Holder silty clay loam, 3 to 6 percent slopes, eroded
HhD2	Holder silty clay loam, 6 to 11 percent slopes, eroded
Hk	Holder silt loam, thick surface, 0 to 1 percent slopes
Hr	Hord silt loam, 0 to 1 percent slopes
HrB	Hord silt loam, 1 to 3 percent slopes
HrC	Hord silt loam, 3 to 6 percent slopes
InB	Inavale loamy sand, 0 to 3 percent slopes
Ma	Massie silt loam, 0 to 1 percent slopes
Or	Ortello fine sandy loam, 0 to 1 percent slopes
OrB	Ortello fine sandy loam, 1 to 3 percent slopes
Ov	Ortello loam, loamy substratum, 0 to 1 percent slopes
OvB	Ortello loam, loamy substratum, 1 to 3 percent slopes
Pb	Pits and Dumps
Pt	Platte loam, 0 to 1 percent slopes
Ru	Rusco silt loam, 0 to 1 percent slopes
Sc	Scott silt loam, 0 to 1 percent slopes
Sd	Scott silty clay loam, drained, 0 to 1 percent slopes
ThD	Thurman fine sandy loam, 3 to 11 percent slopes
ThF	Thurman fine sandy loam, 11 to 30 percent slopes
Uy	Uly silt loam, 0 to 1 percent slopes
UyB	Uly silt loam, 1 to 3 percent slopes
UyC	Uly silt loam, 3 to 6 percent slopes
UYE2	Uly silt loam, 11 to 17 percent slopes, eroded
UyF	Uly silt loam, 11 to 30 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- County or parish
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery — Davis Airstrip

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Located object (label) — Tower

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
- Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

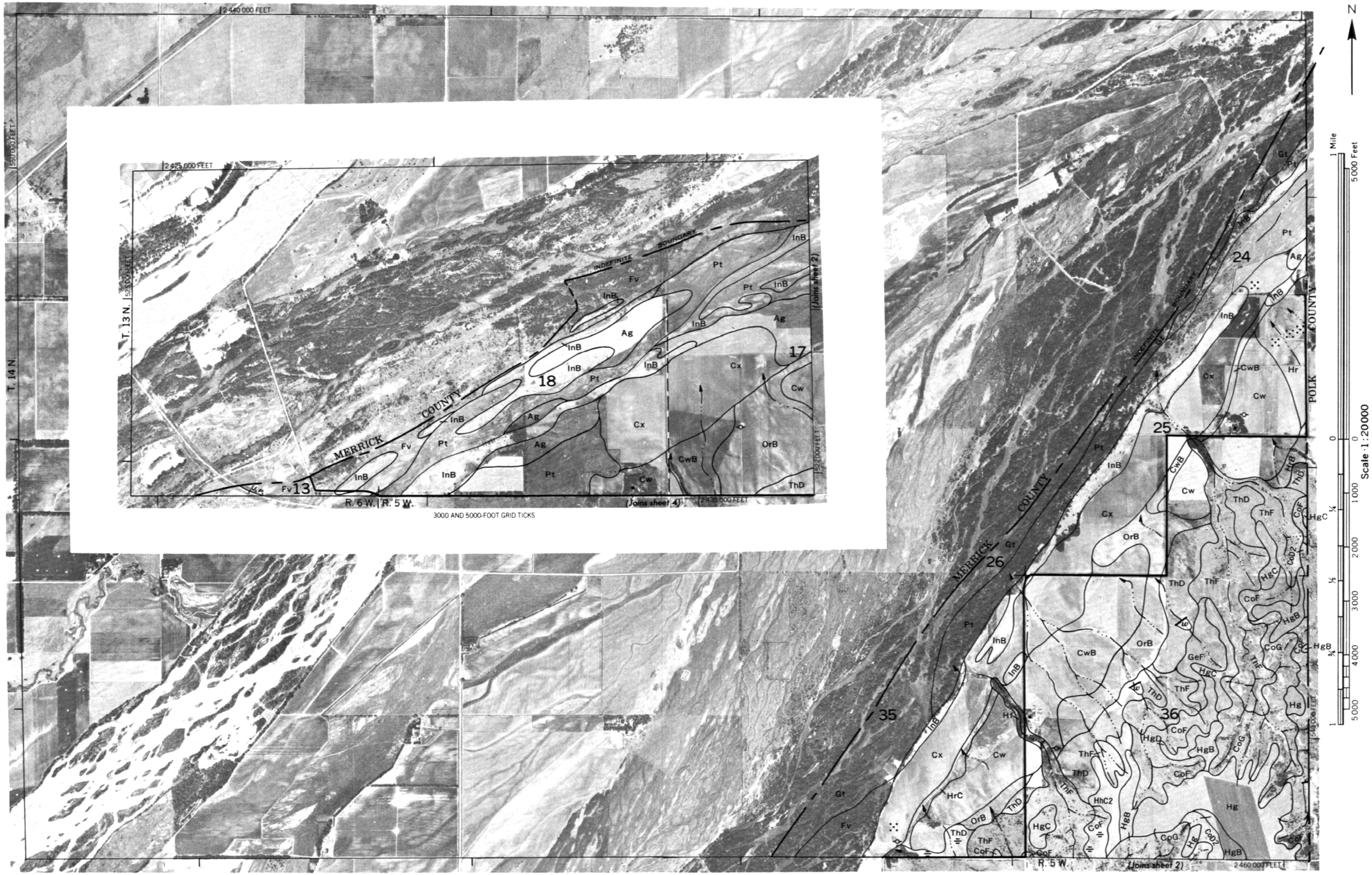
SOIL DELINEATIONS AND SYMBOLS — Cy, HhC2

SHORT STEEP SLOPE

DEPRESSION OR SINK

MISCELLANEOUS

- Gravelly spot
- Saline spot
- Sandy spot
- Severely eroded spot
- Stony spot, very stony spot
- Reddish brown loess outcrop
- Inlet to tile drains
- Cut areas



HAMILTON COUNTY, NEBRASKA NO. 1

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2

N

1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3

N

1 Mile

5000 Feet

Scale 1:20000

HAMILTON COUNTY, NEBRASKA NO. 3

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

4

N

1 Mile

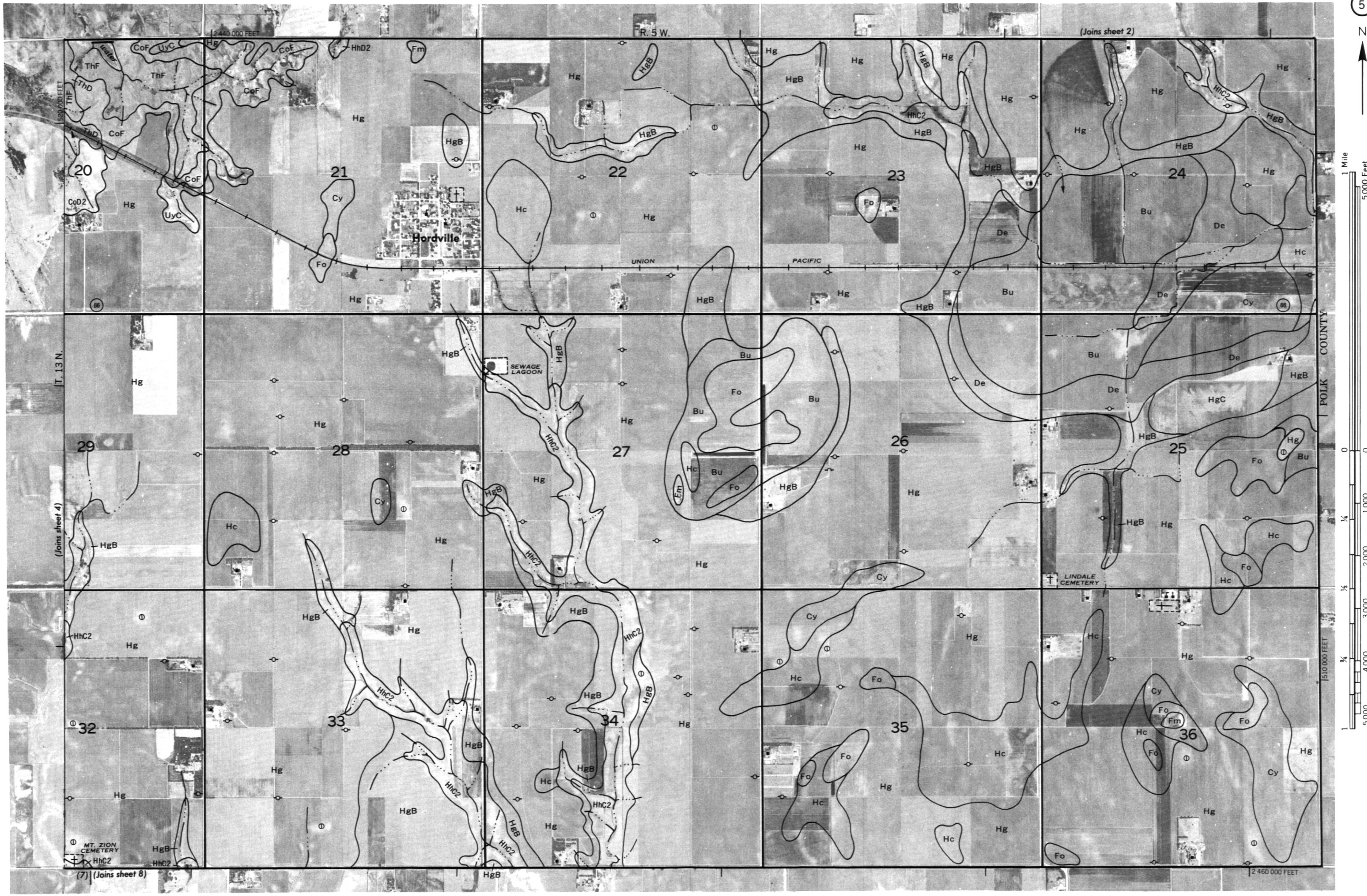
5000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

Scale 1:20000

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



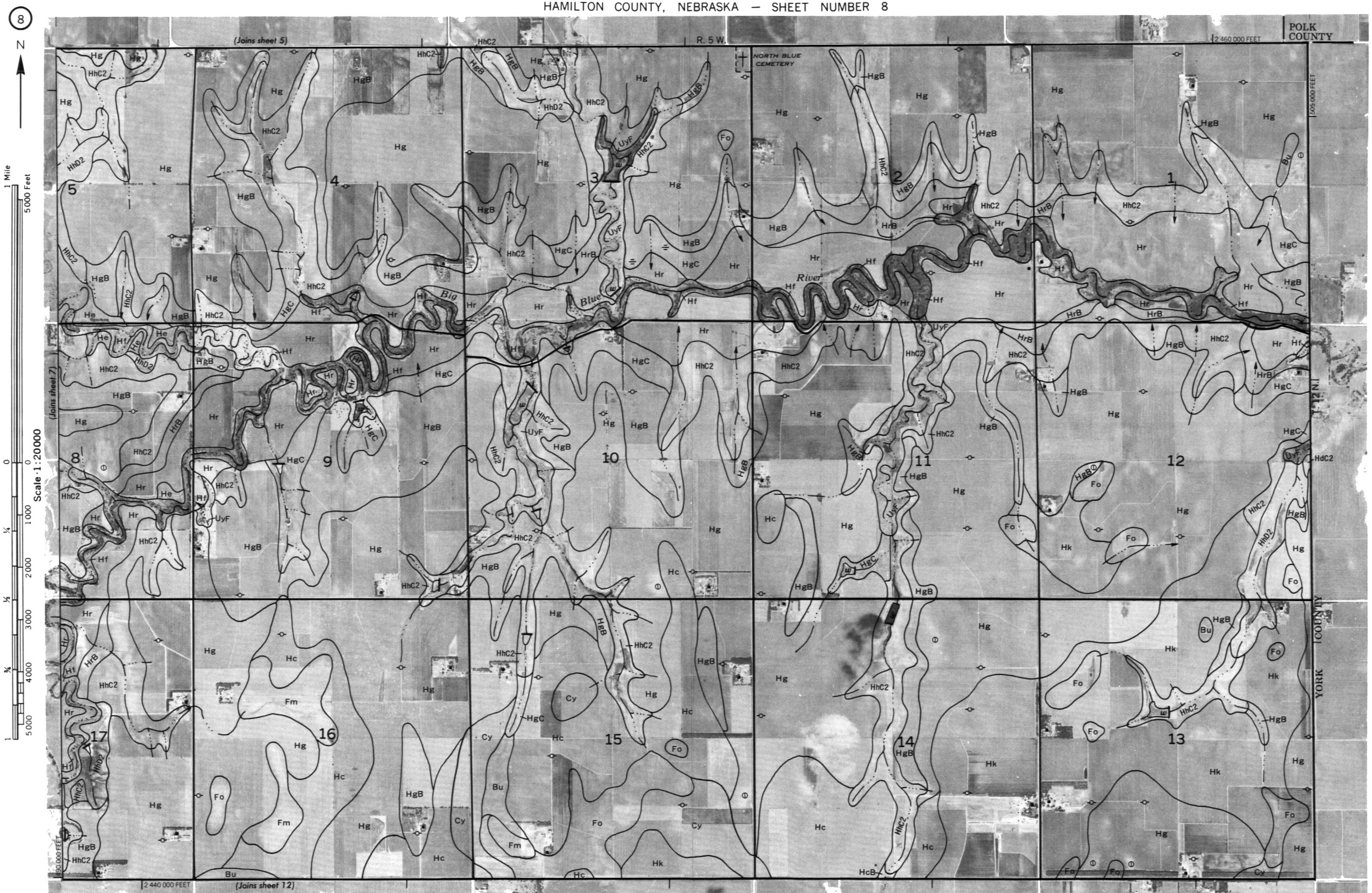
HAMILTON COUNTY, NEBRASKA NO. 5
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 6

HAMILTON COUNTY, NEBRASKA NO. 7

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

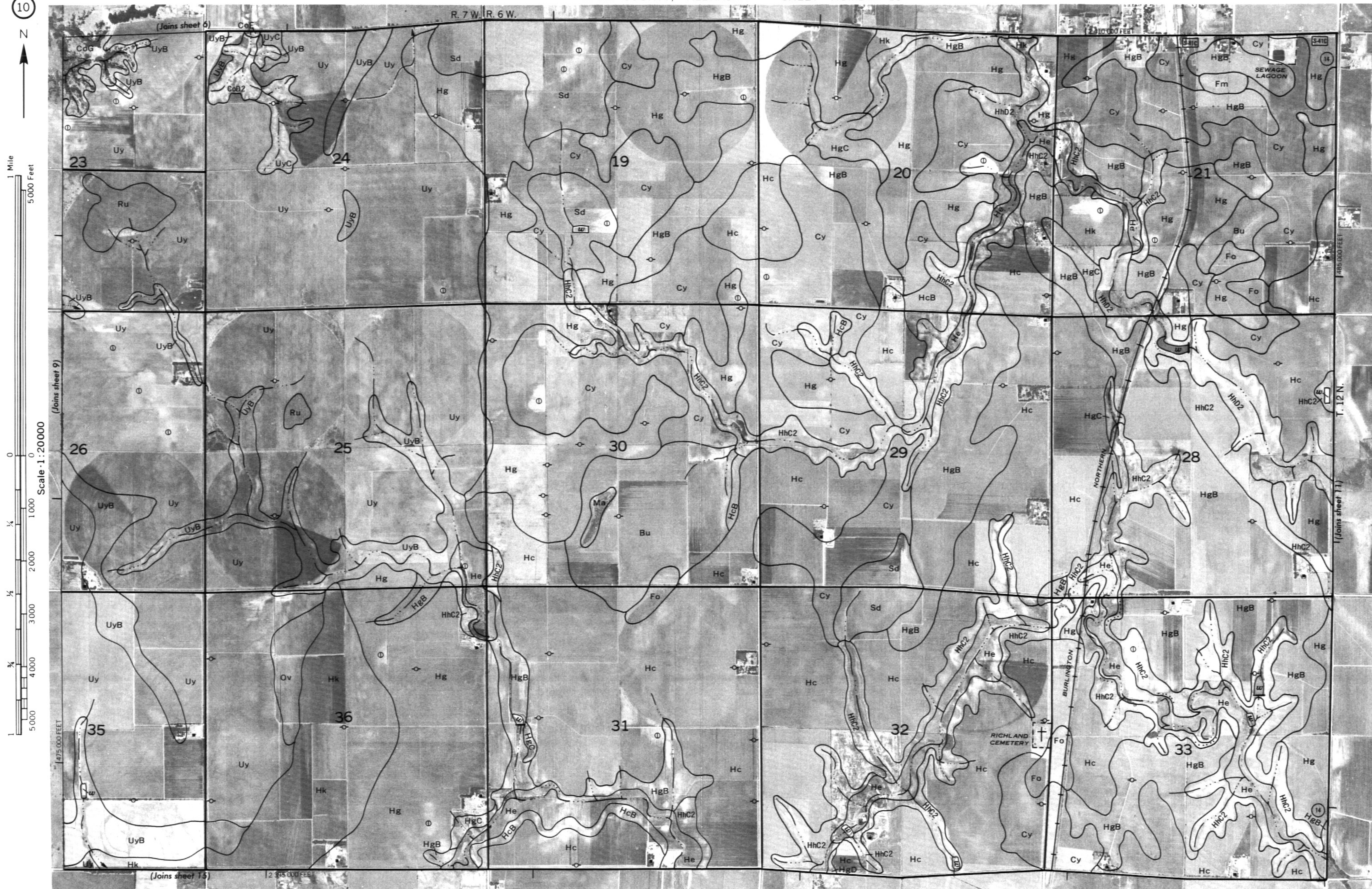


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 8

HAMILTON COUNTY, NEBRASKA NO. 9

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

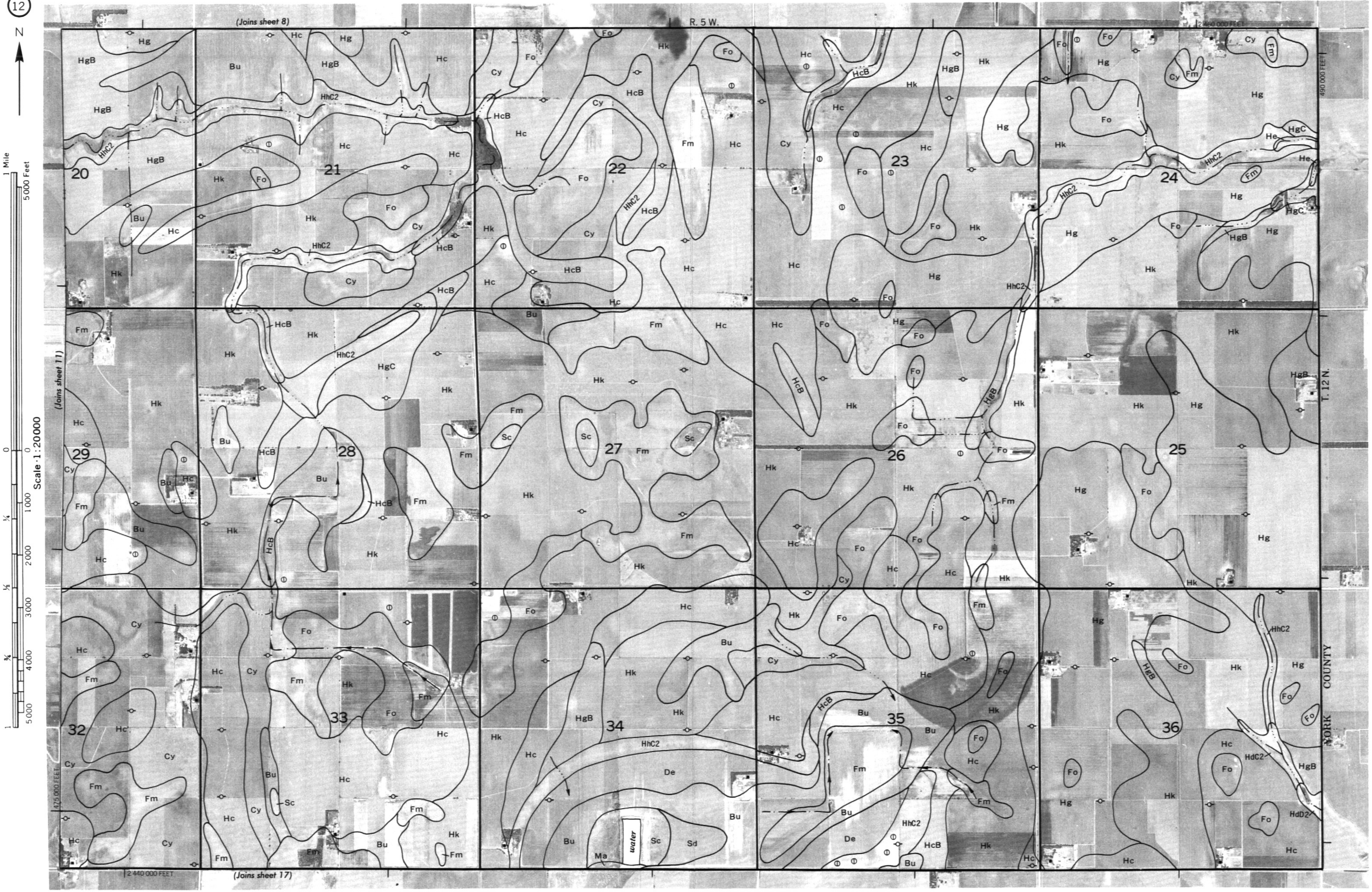


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

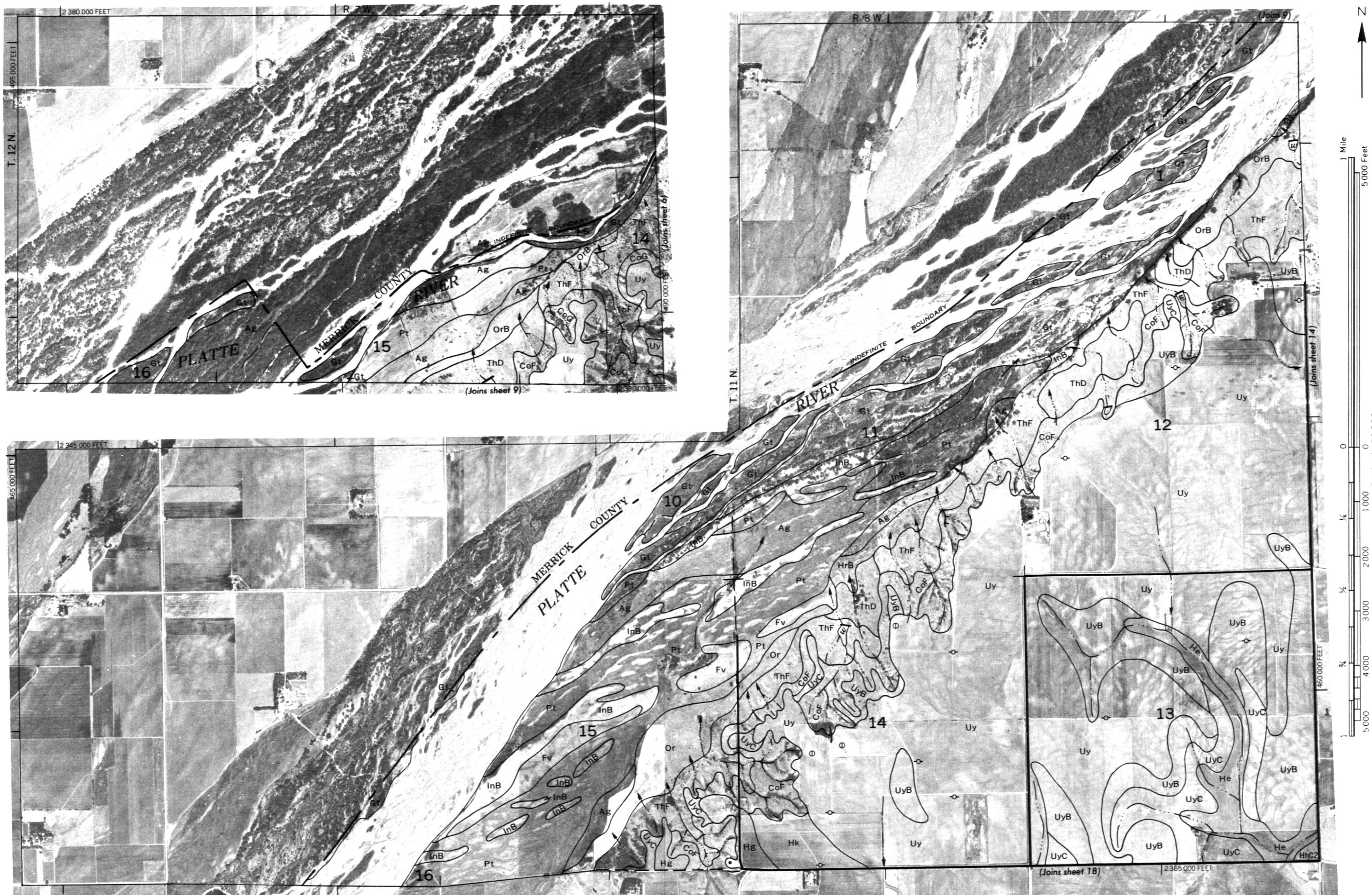
HAMILTON COUNTY, NEBRASKA NO. 11

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA — SHEET NUMBER 12



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



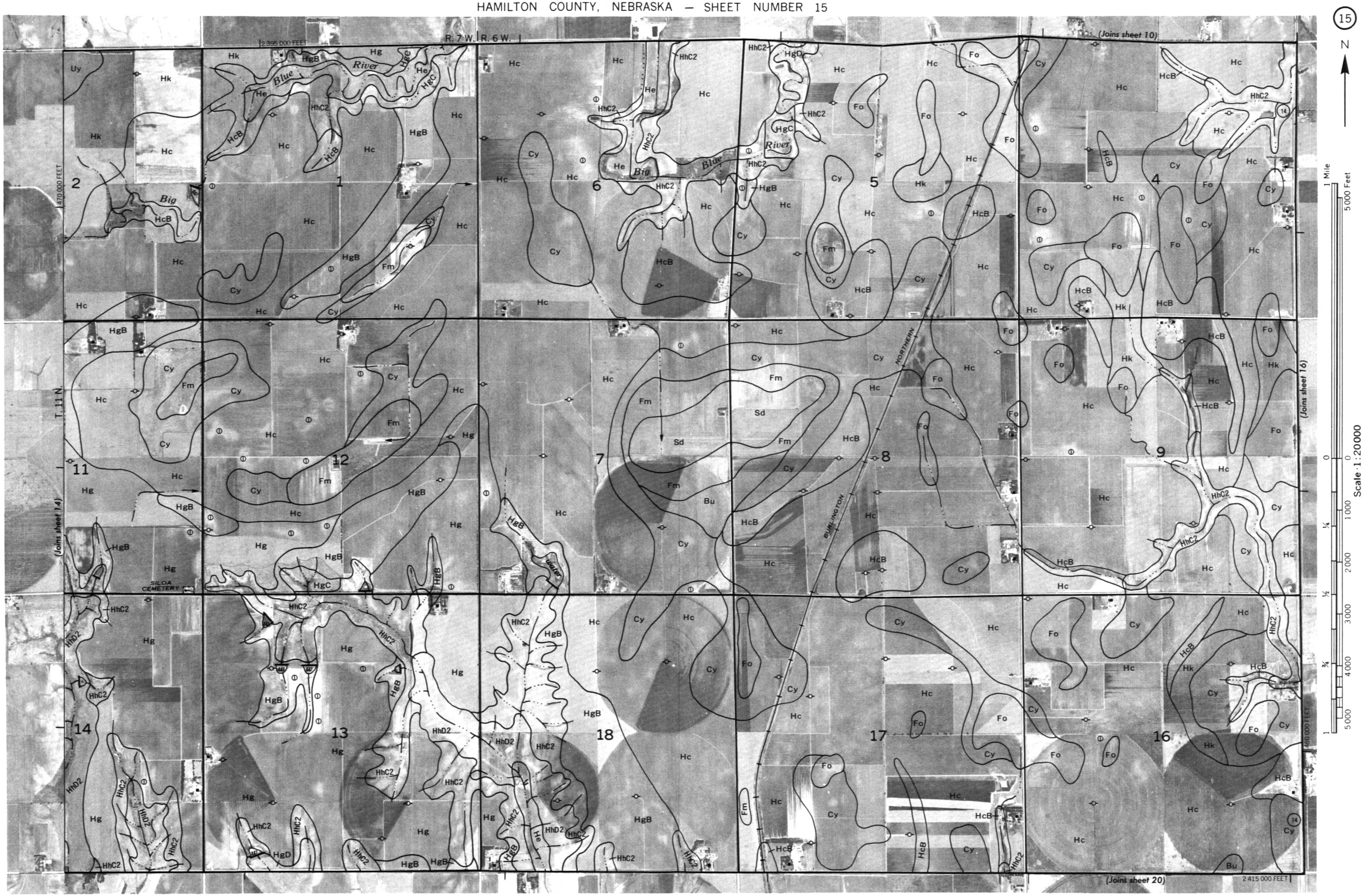
HAMILTON COUNTY, NEBRASKA NO. 13

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA — SHEET NUMBER 14

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 14



HAMILTON COUNTY, NEBRASKA NO. 15

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA — SHEET NUMBER 16

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

HAMILTON COUNTY, NEBRASKA NO. 16

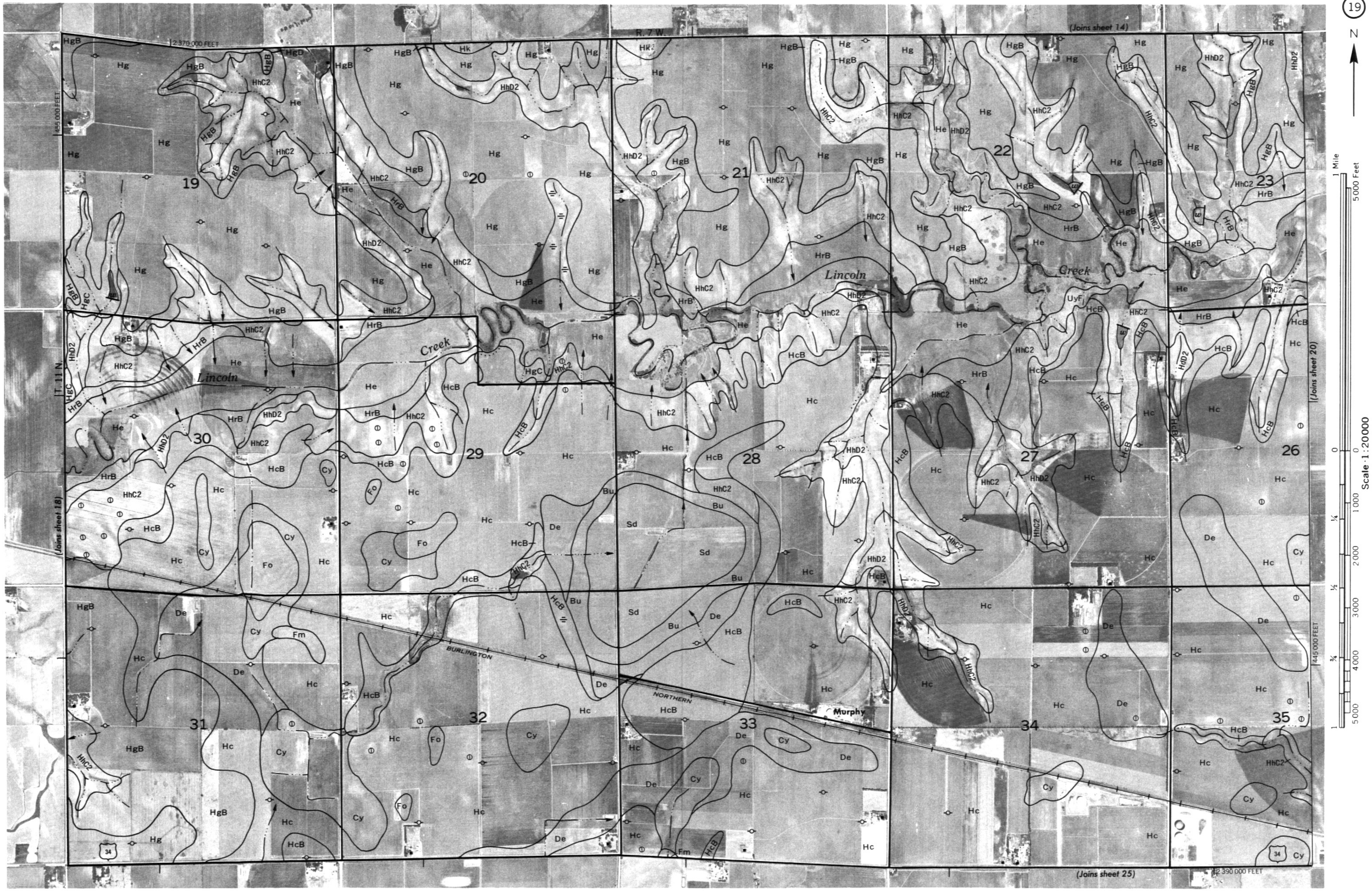
HAMILTON COUNTY, NEBRASKA NO. 17

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

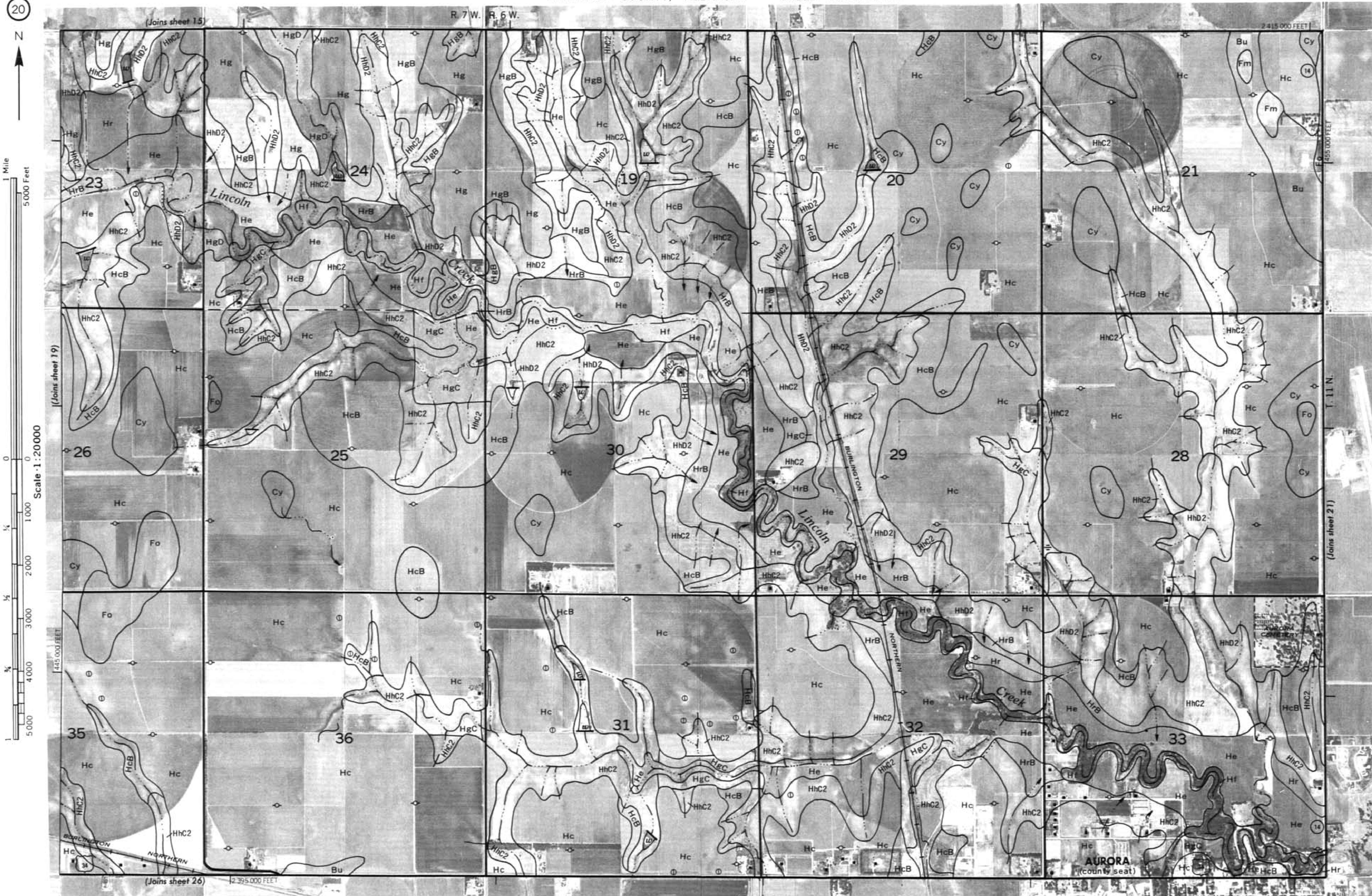
HAMILTON COUNTY, NEBRASKA — SHEET NUMBER 18

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 18



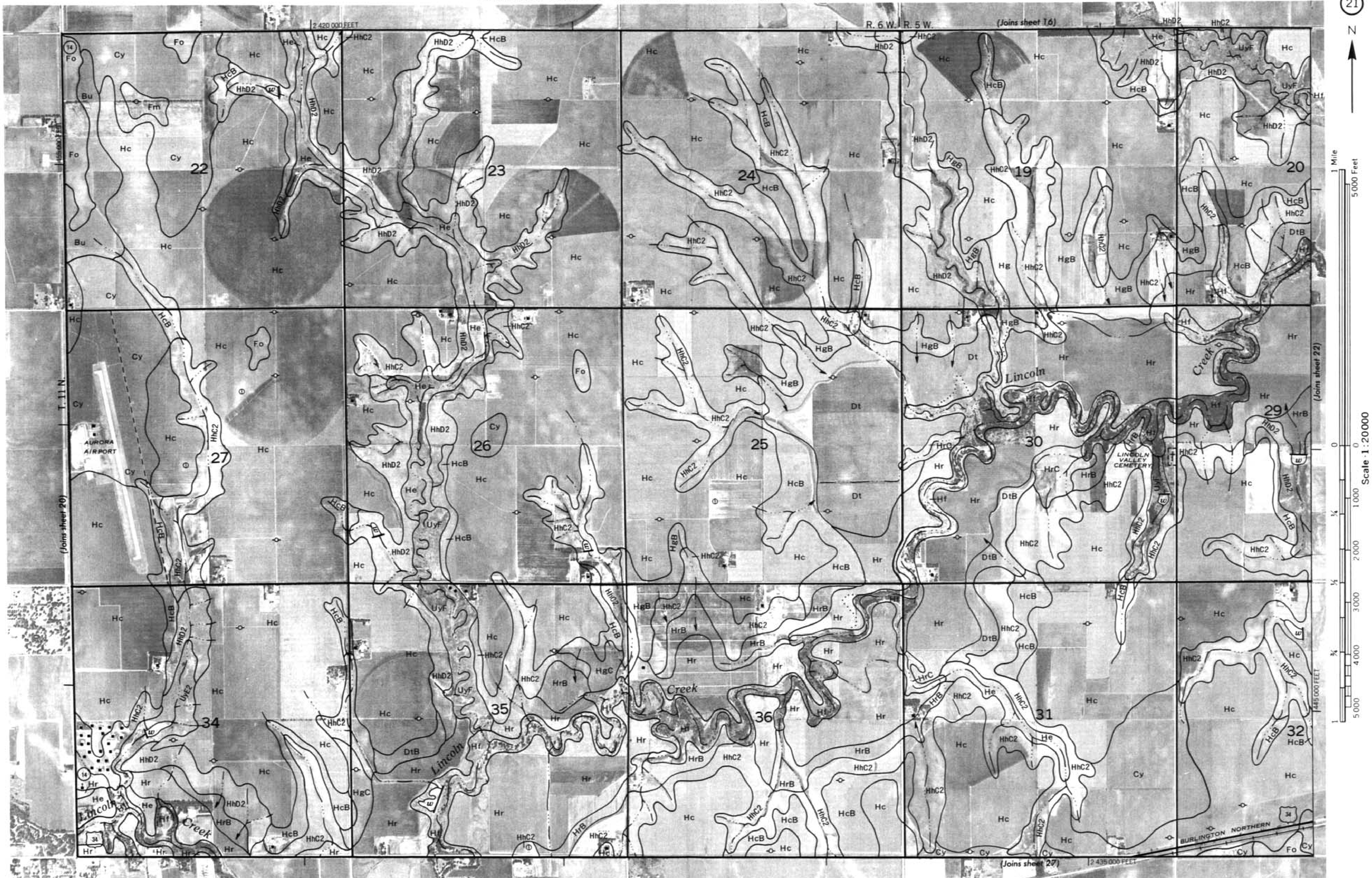
HAMILTON COUNTY, NEBRASKA NO. 19
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



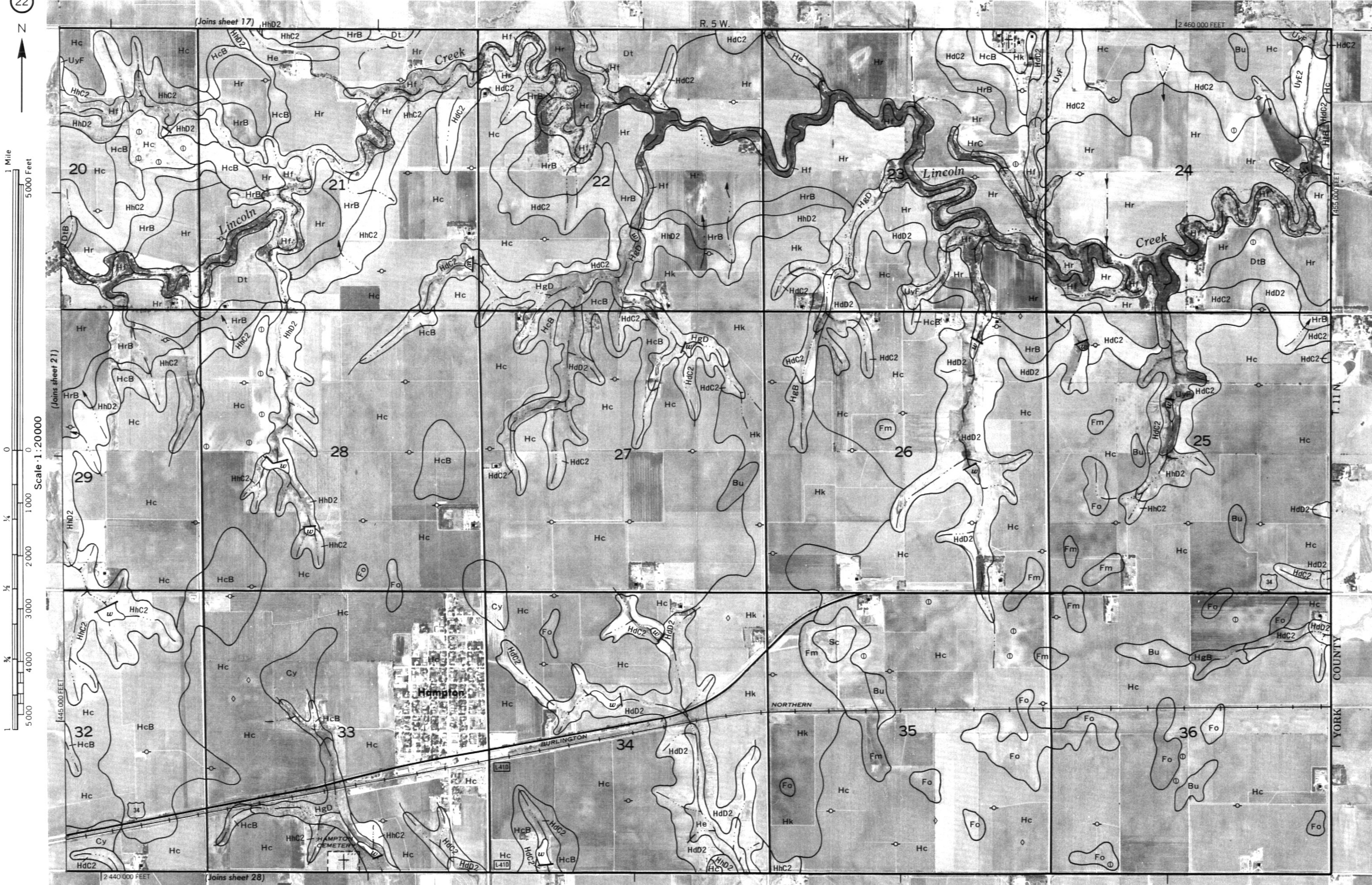
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 21

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



HAMILTON COUNTY, NEBRASKA — SHEET NUMBER 22



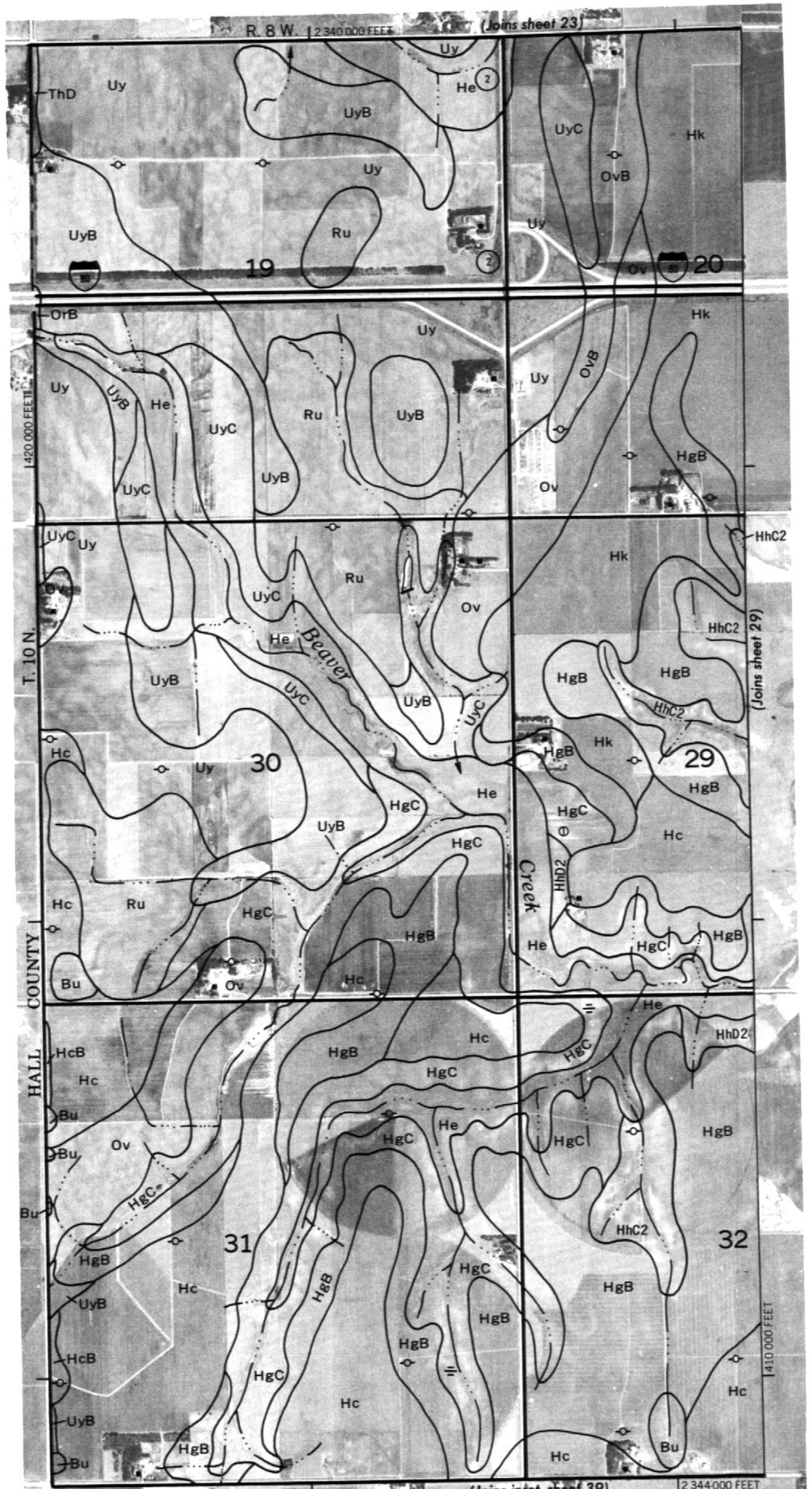
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 22

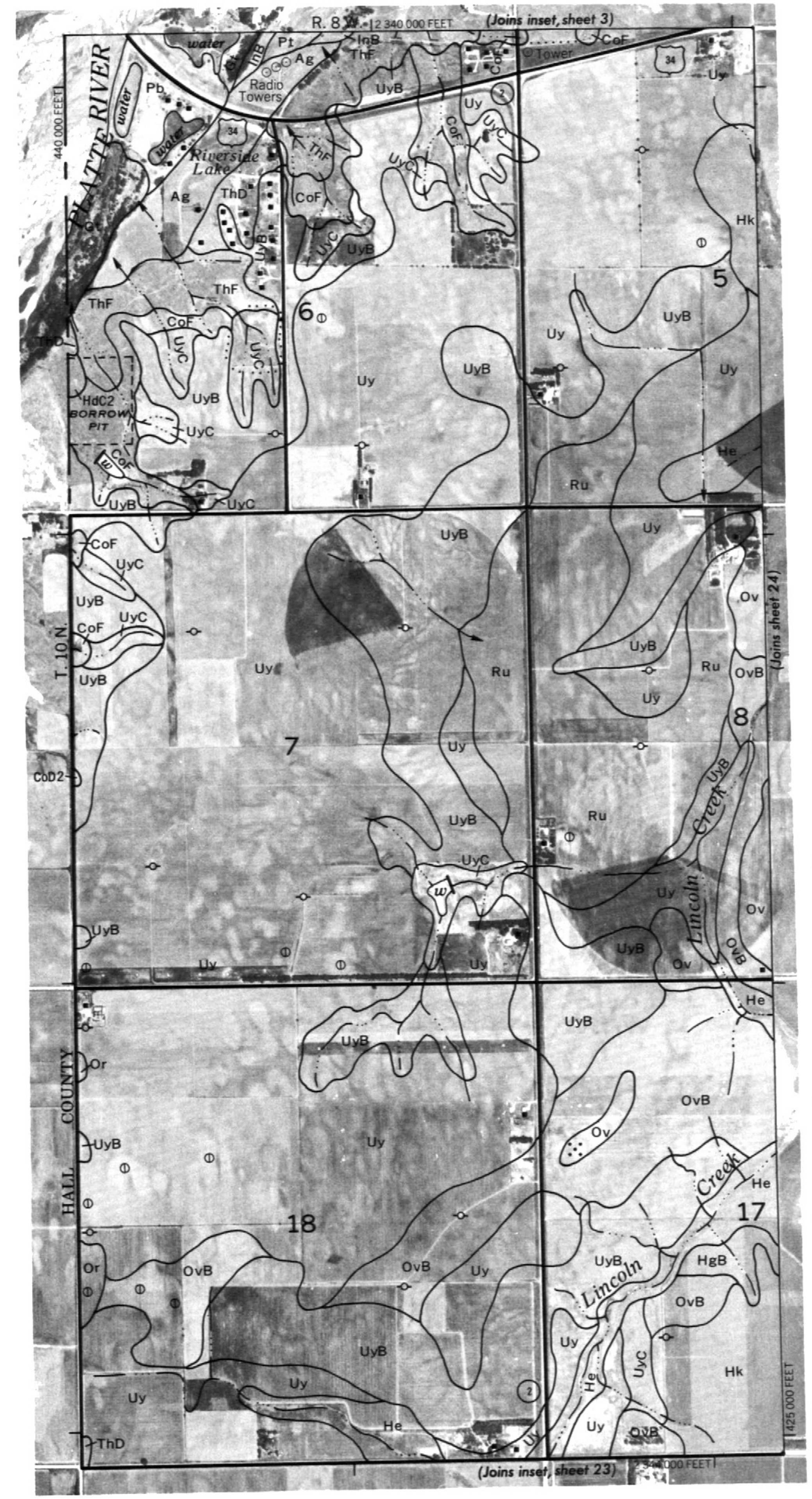
(23)

HAMILTON COUNTY, NEBRASKA NO. 23

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



4000 AND 5000-FOOT GRID TICKS



4000 AND 5000-FOOT GRID TICKS

N

1 Mile

5000 Feet

0

¼

½

¾

1

0

1000

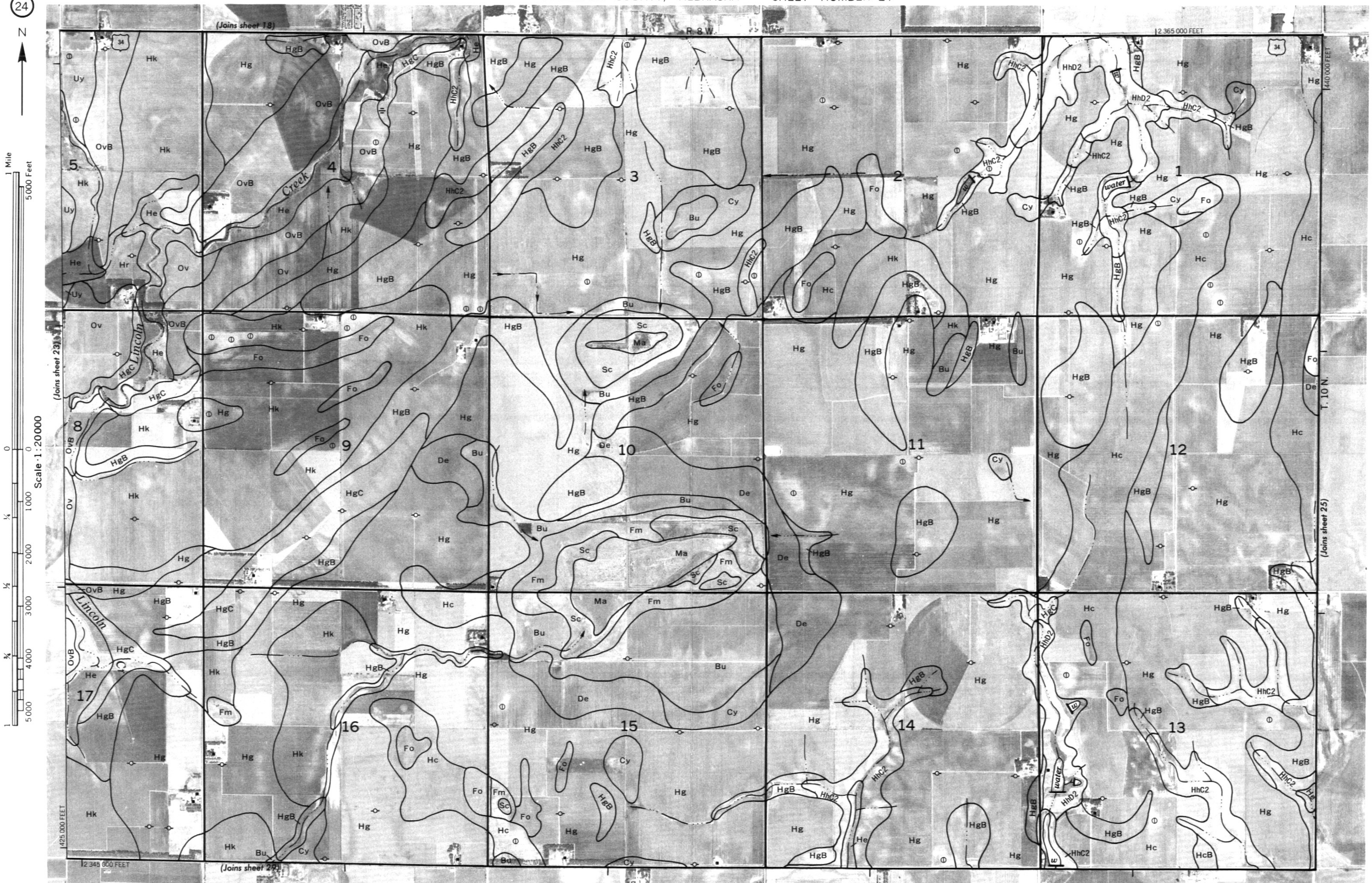
2000

3000

4000

5000

Scale 1:20000



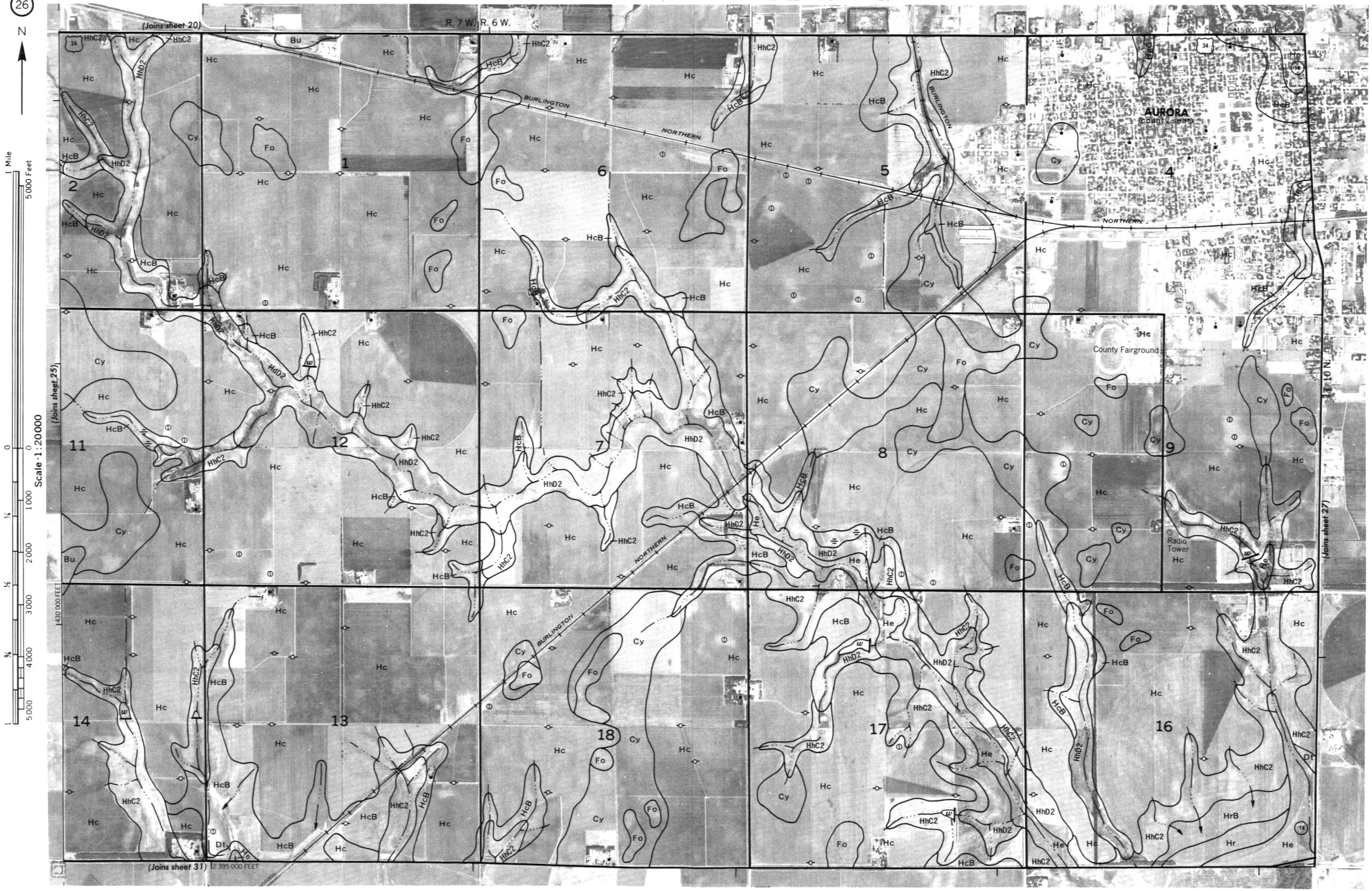
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 24

HAMILTON COUNTY, NEBRASKA NO. 25

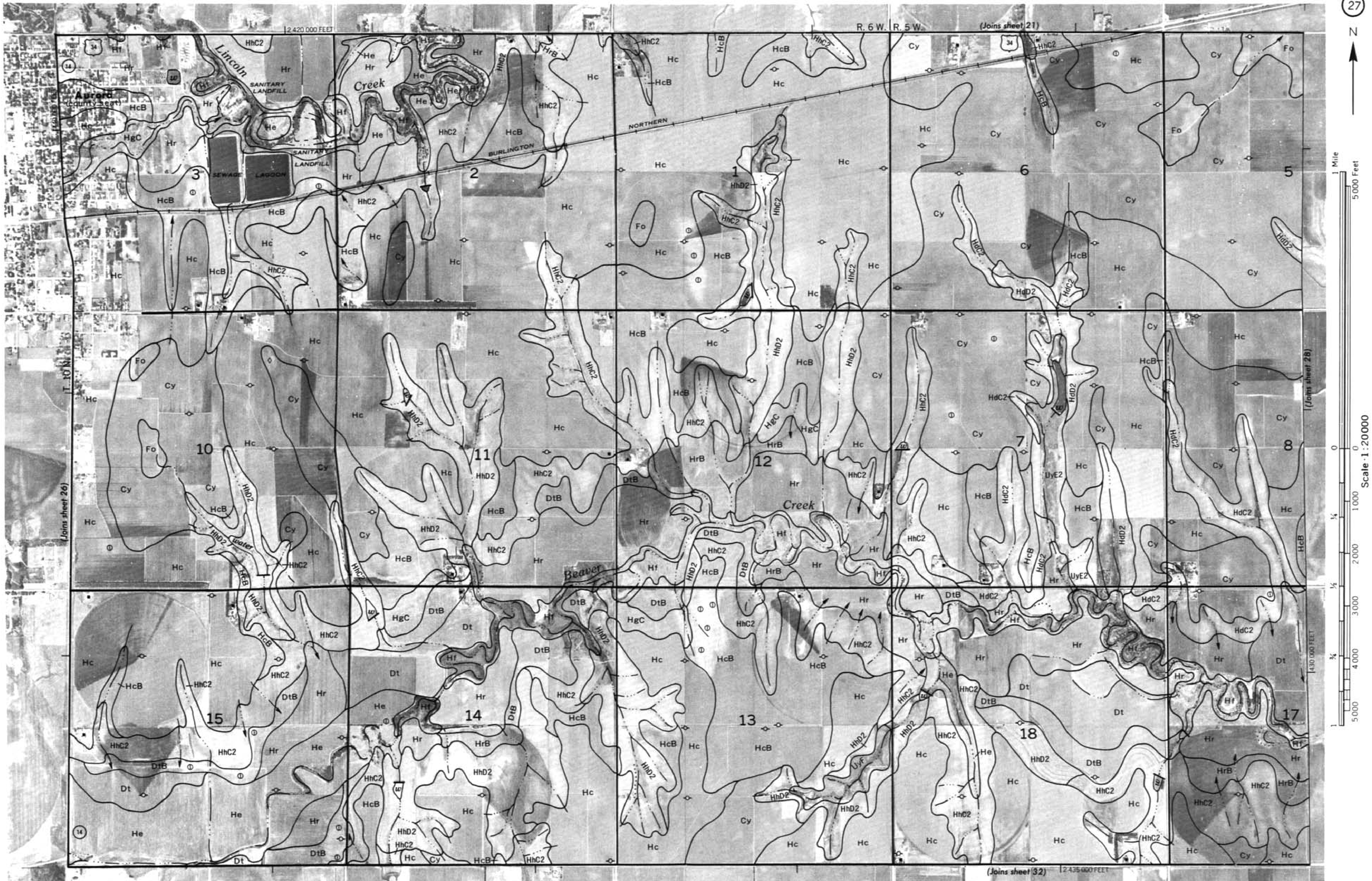
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA — SHEET NUMBER 26



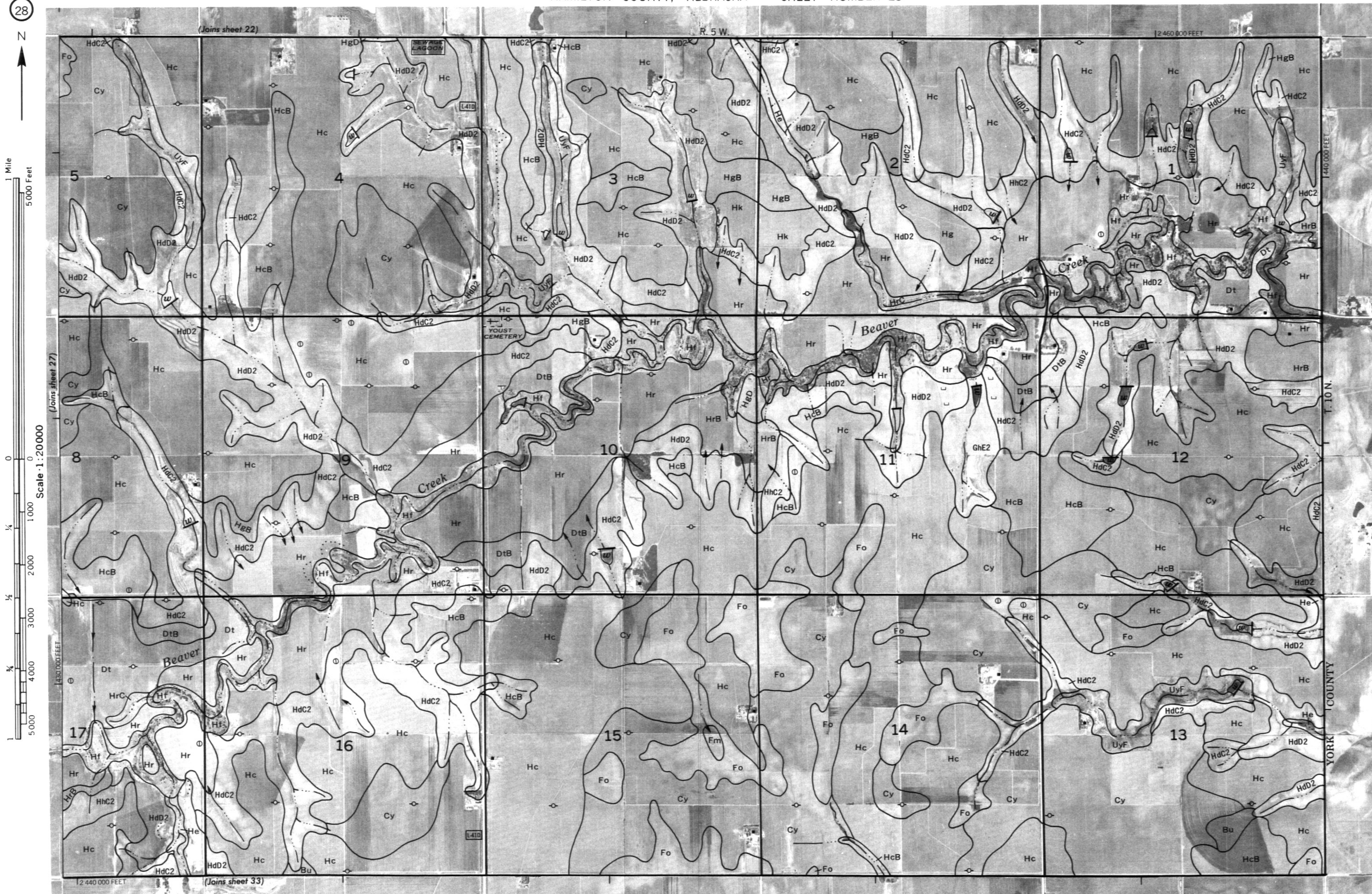
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 26



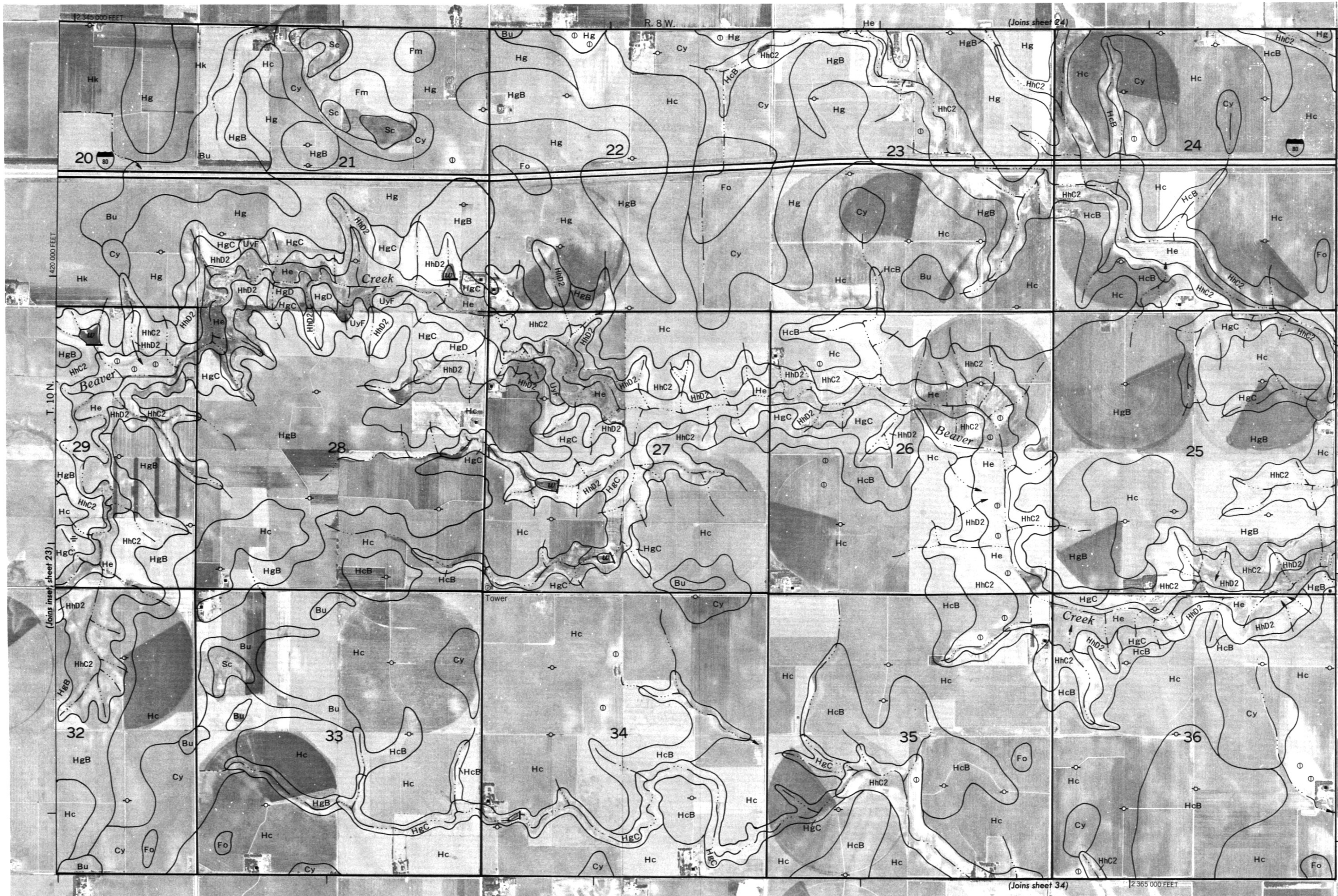
HAMILTON COUNTY, NEBRASKA NO. 27

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

29



N

Scale 1:20000

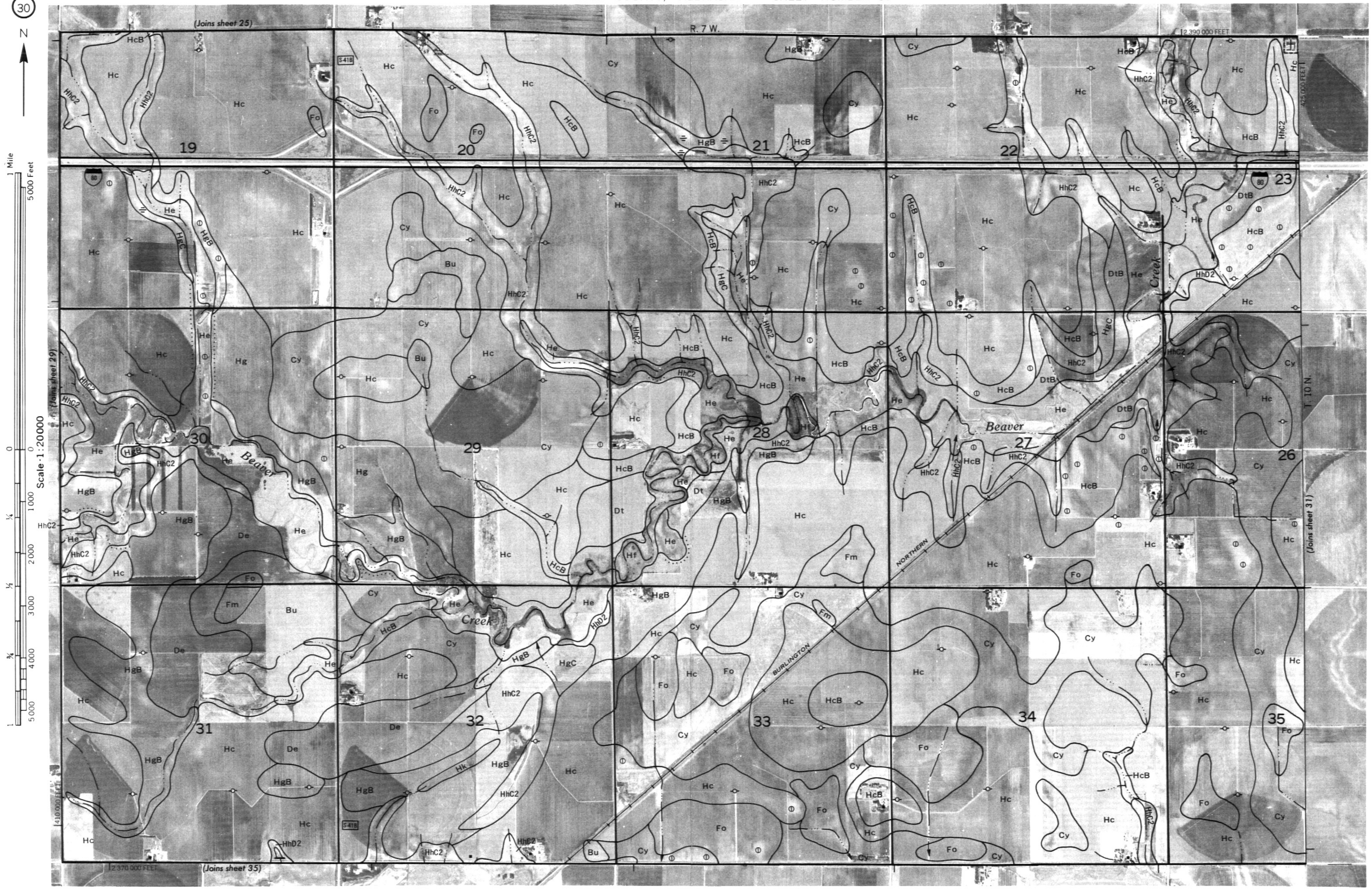
1 Mile

5000 Feet

HAMILTON COUNTY, NEBRASKA NO. 29

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

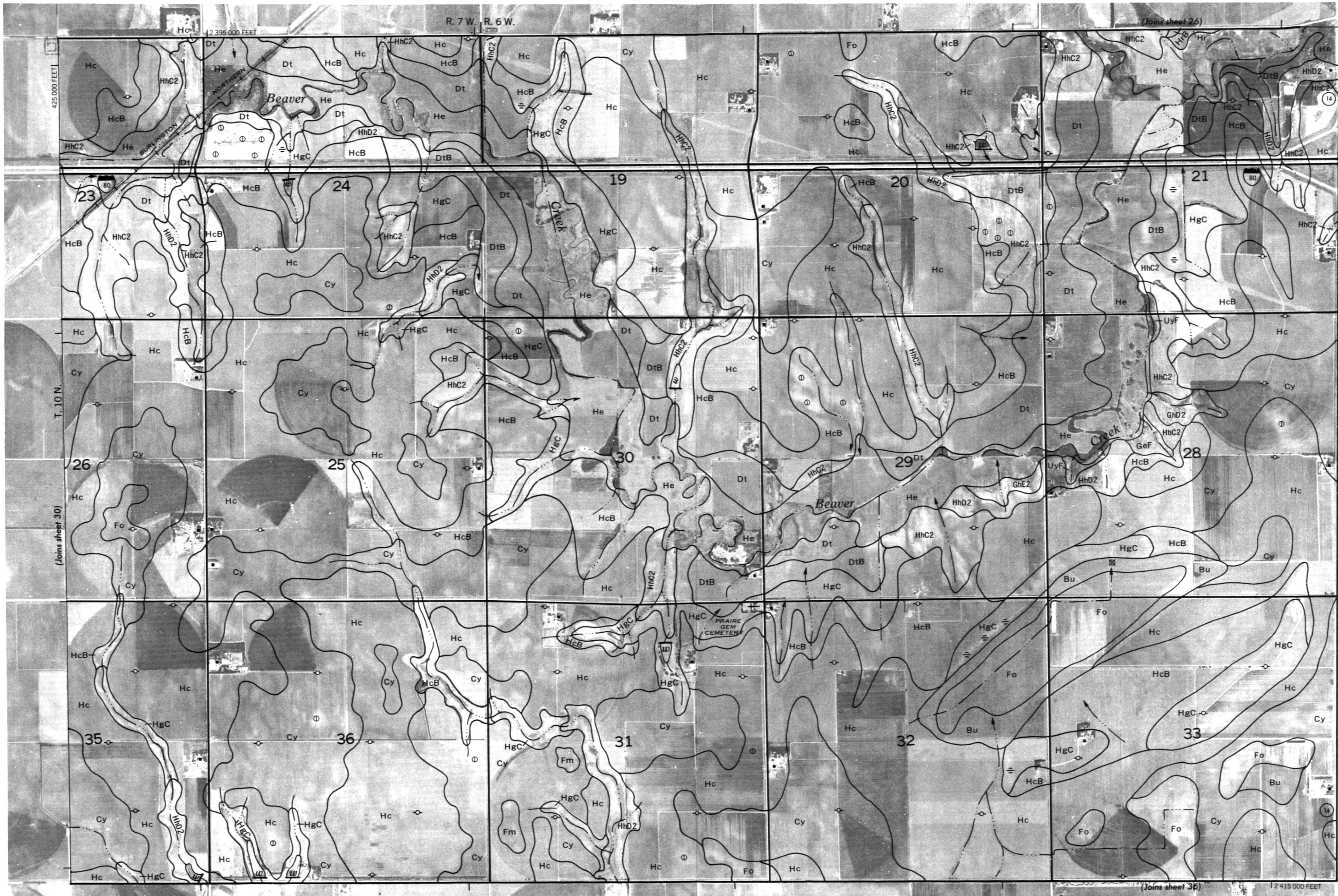
HAMILTON COUNTY, NEBRASKA — SHEET NUMBER 30



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 30

(31)



N

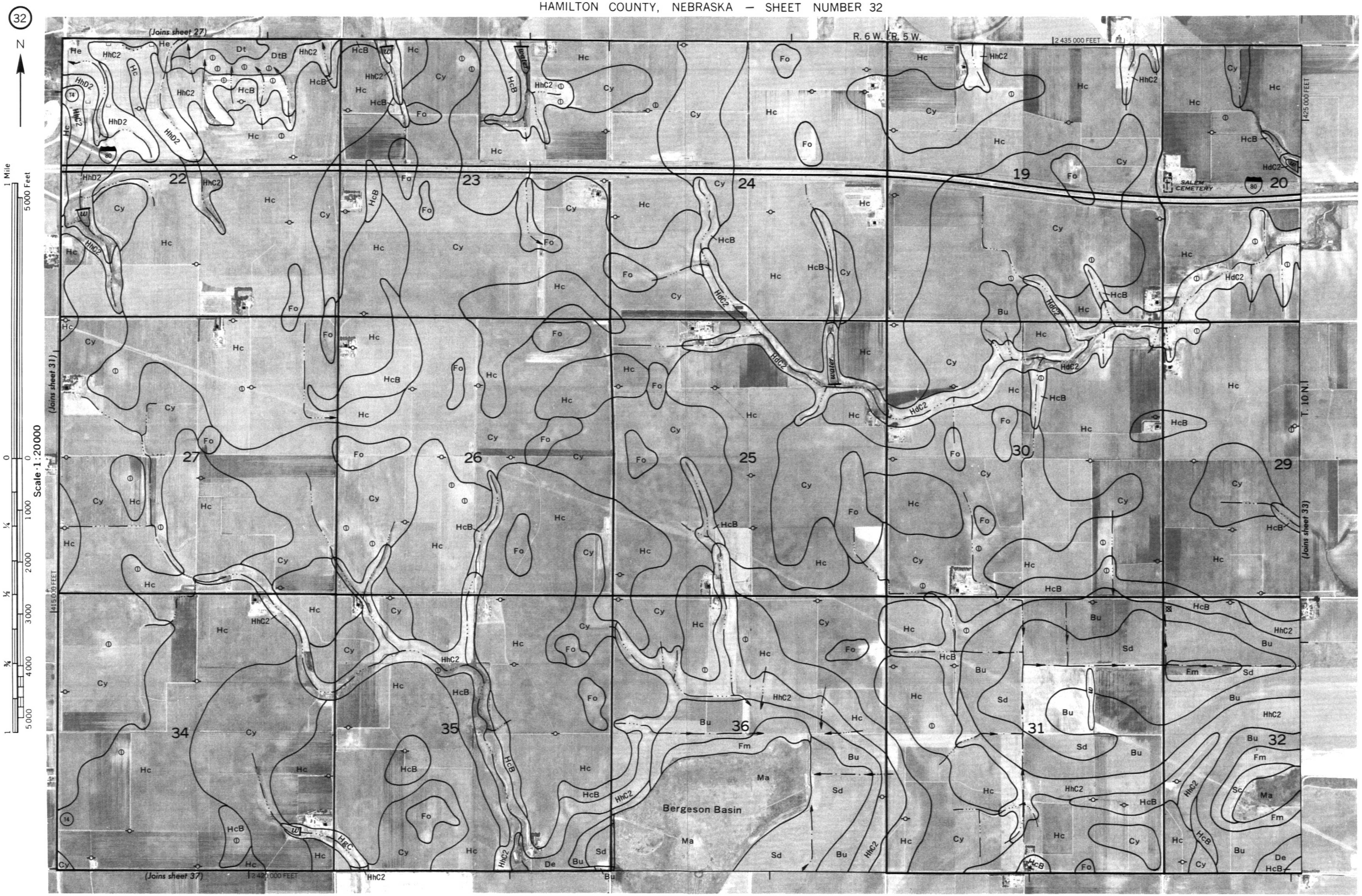
Scale 1:20000

1 Mile

5000 Feet

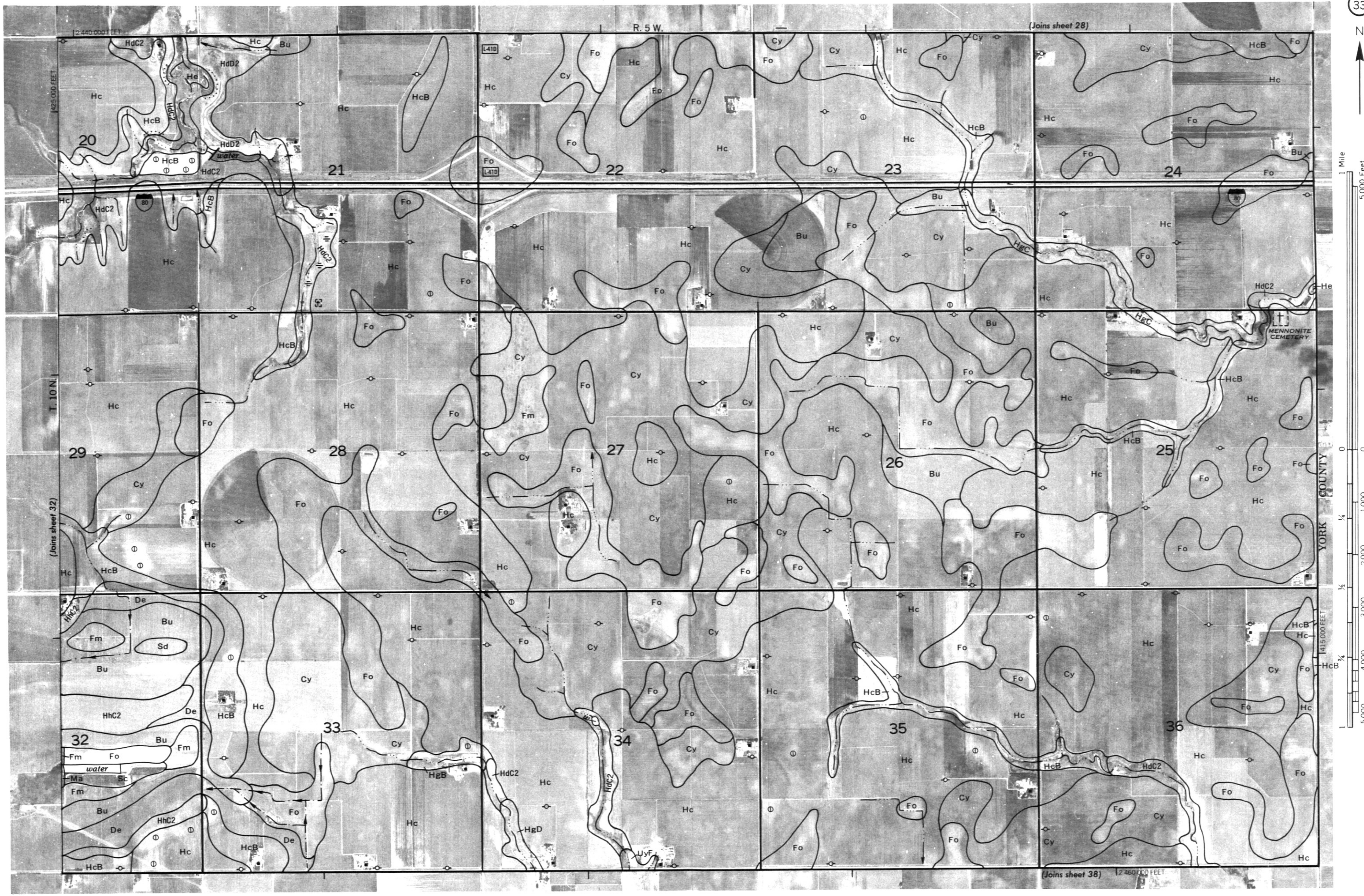
HAMILTON COUNTY, NEBRASKA NO. 31

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

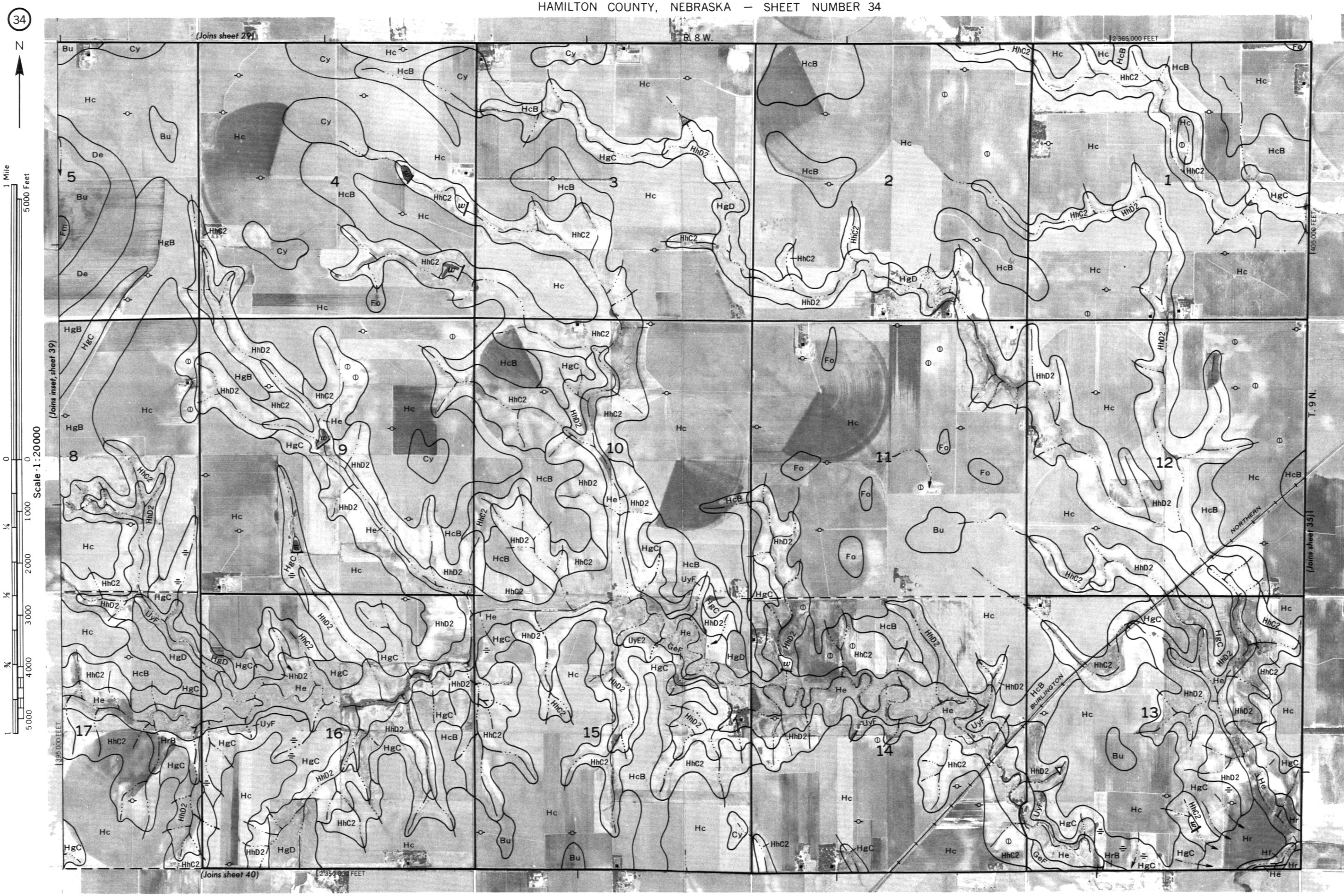
HAMILTON COUNTY, NEBRASKA NO. 32



HAMILTON COUNTY, NEBRASKA NO. 33

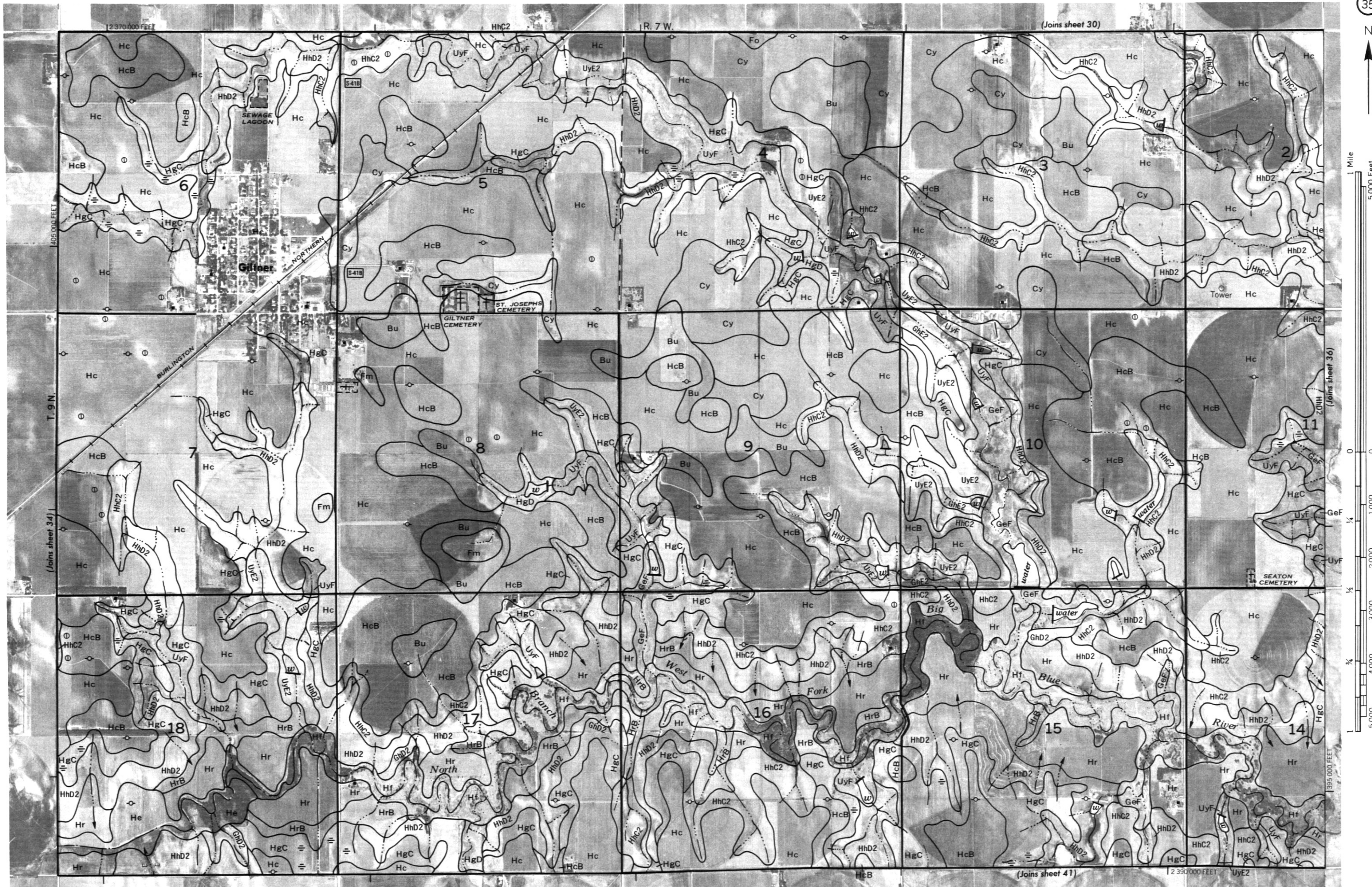
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA — SHEET NUMBER 34



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 34



HAMILTON COUNTY, NEBRASKA NO. 35

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

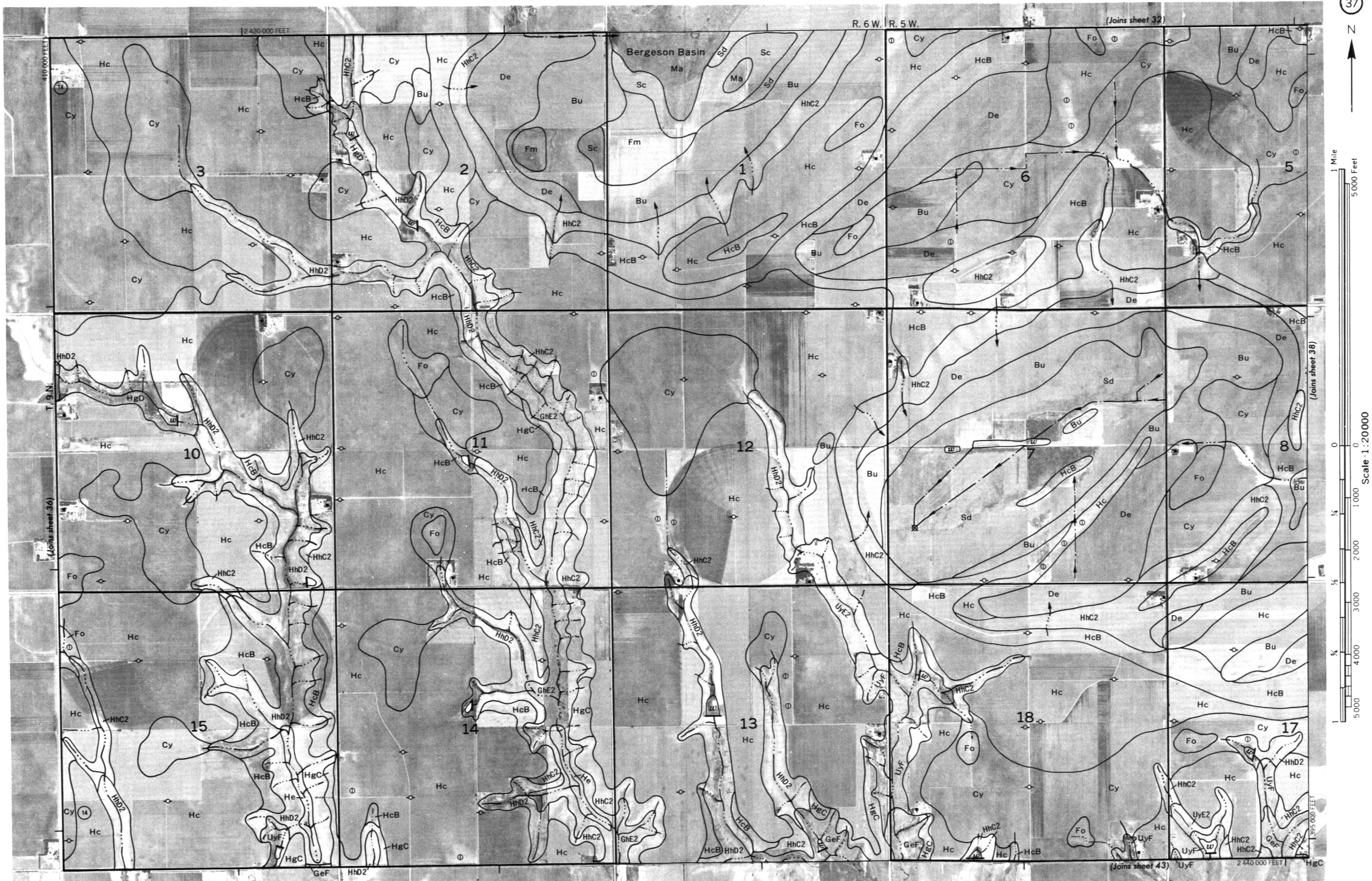
36

N

1 Mile
5000 Feet

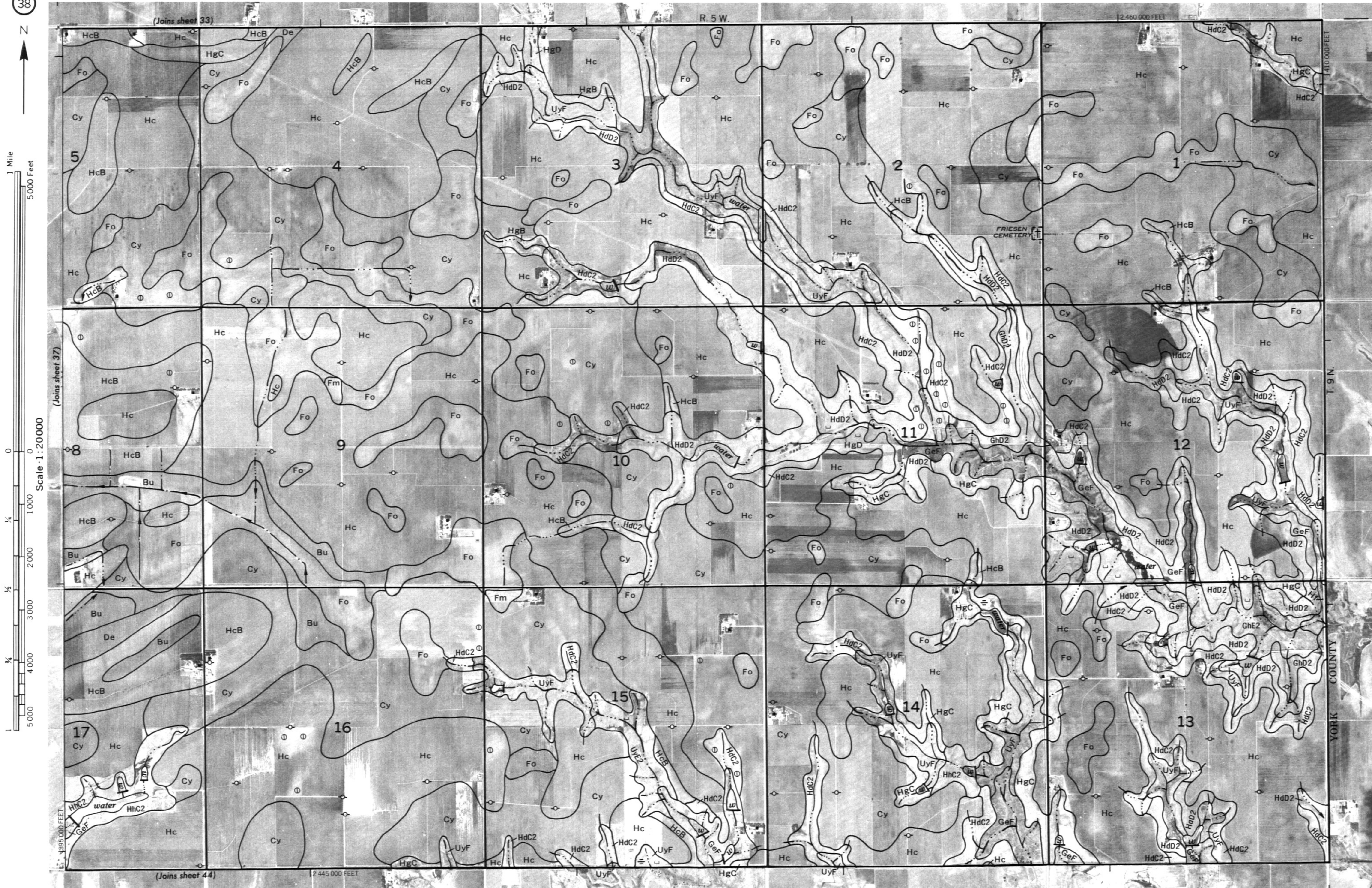
Scale 1:20000

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



HAMILTON COUNTY, NEBRASKA NO. 37

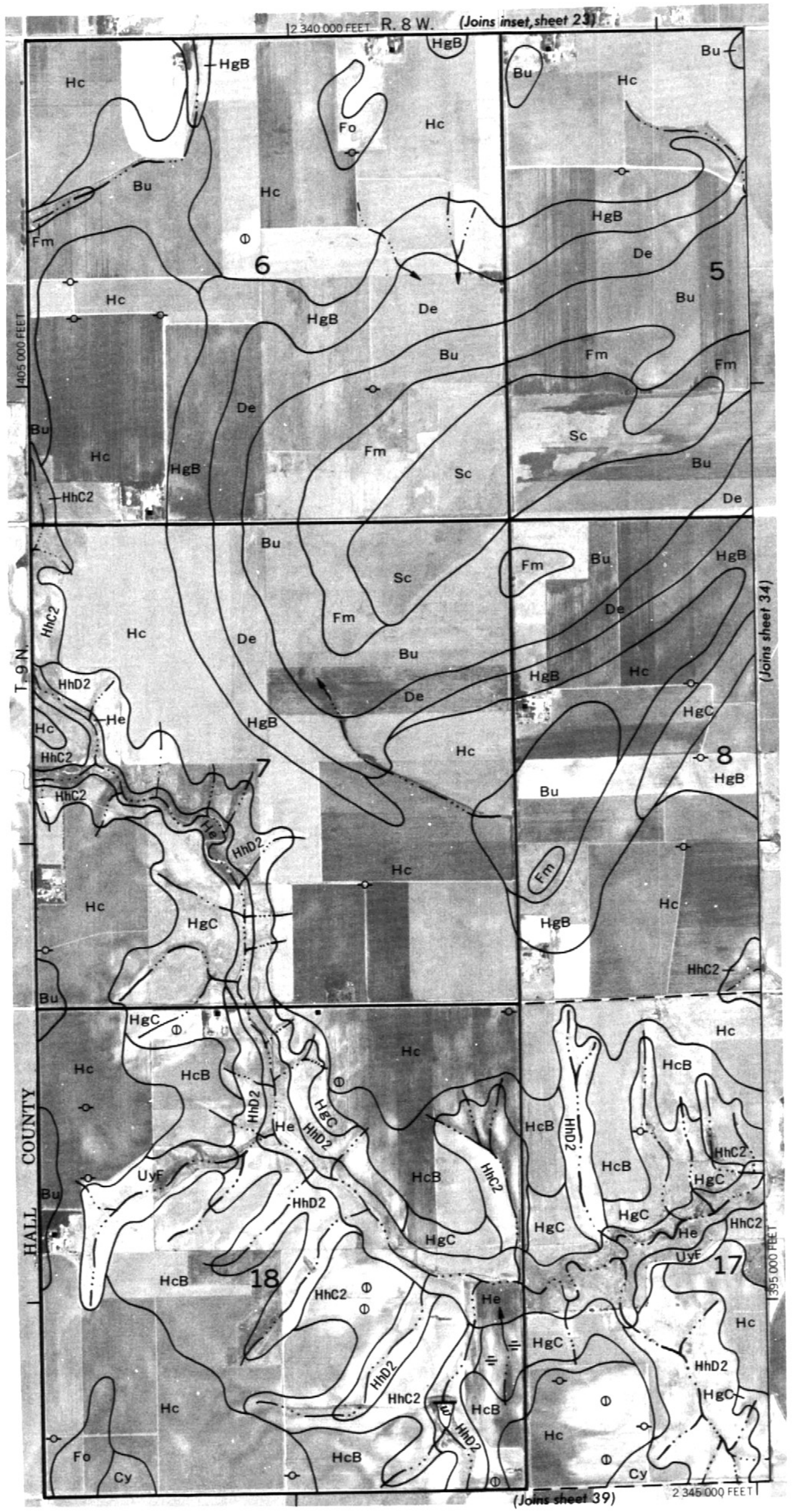
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

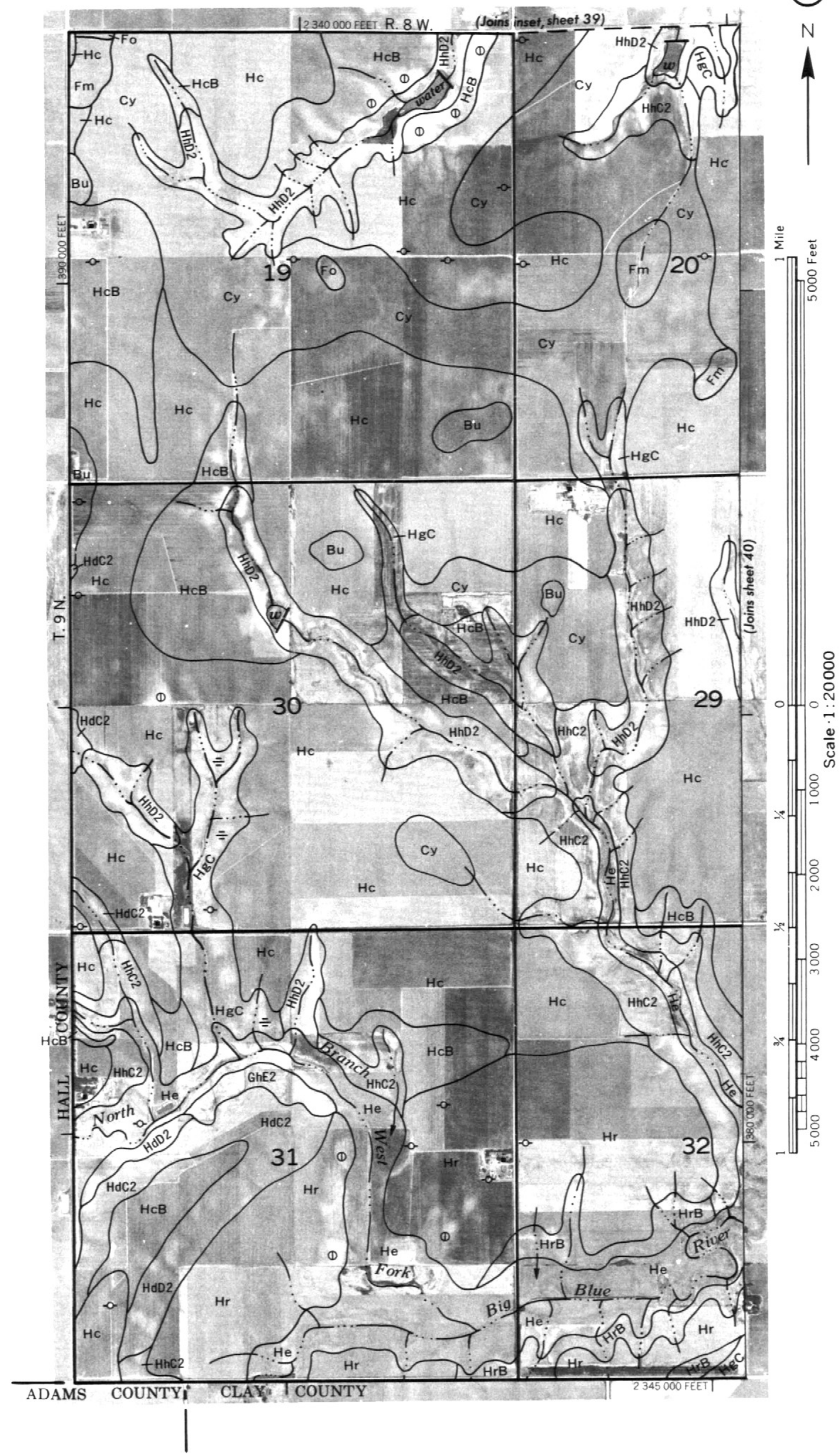


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 39

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

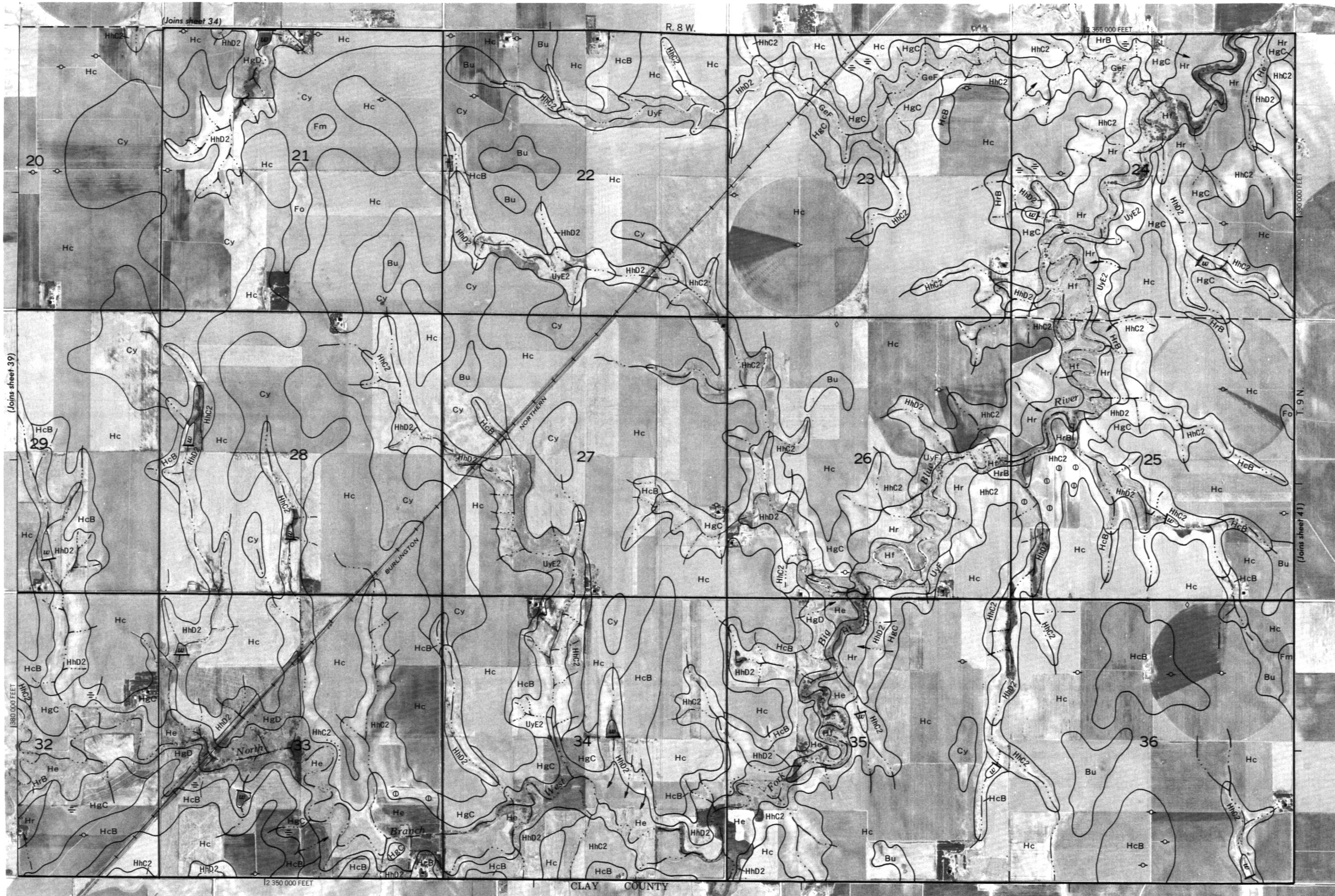




HAMILTON COUNTY, NEBRASKA — SHEET NUMBER 40

N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

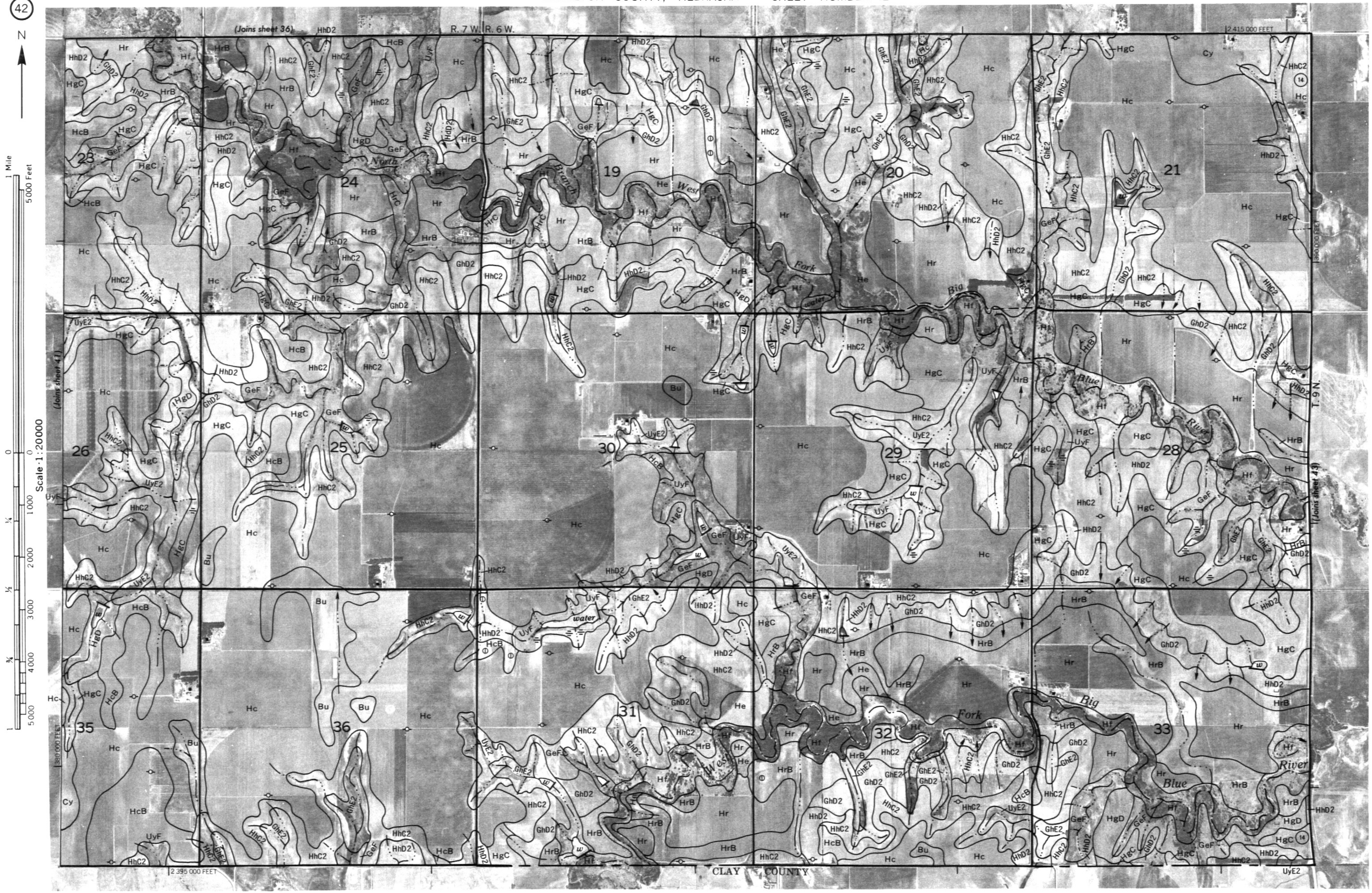


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 40

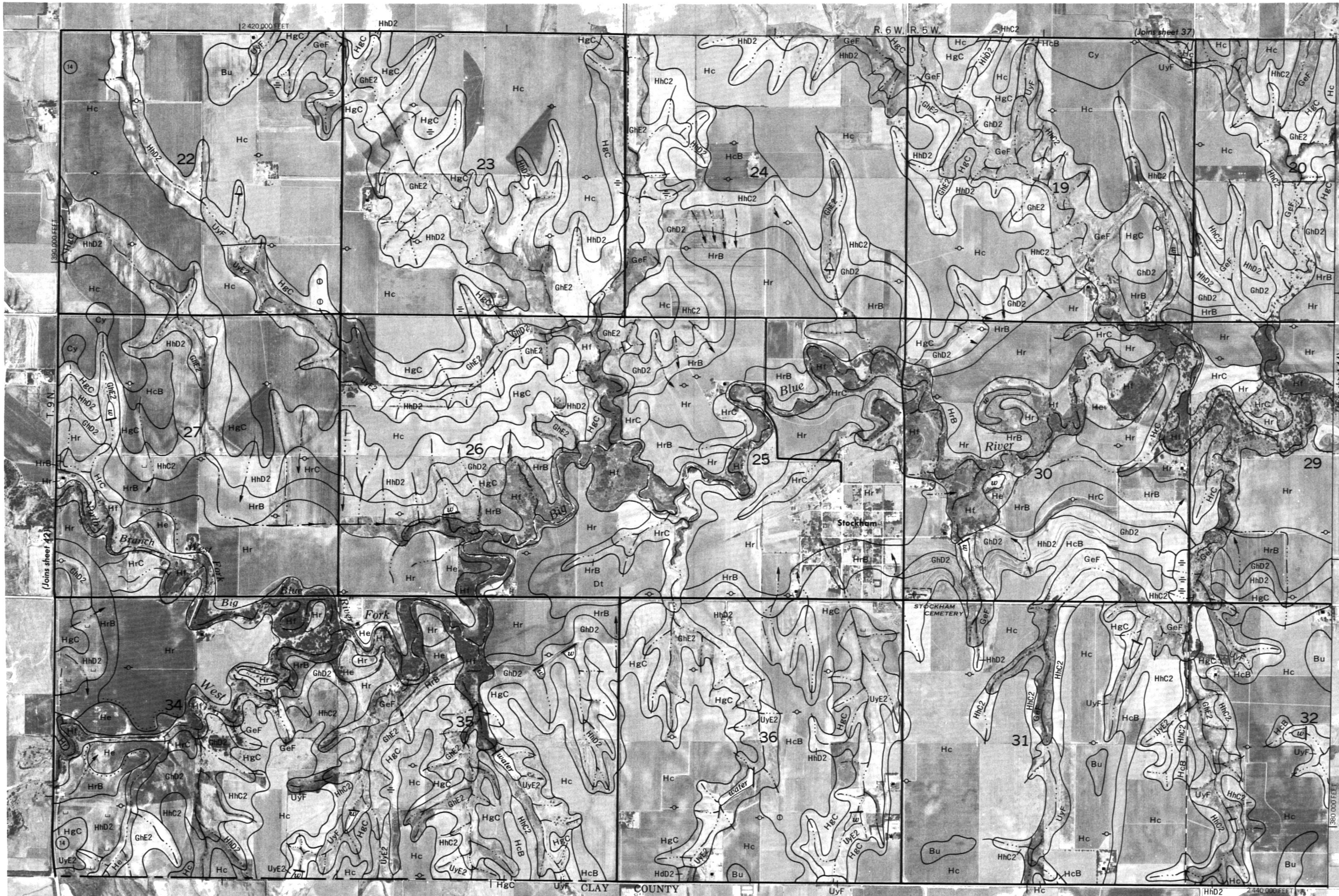
HAMILTON COUNTY, NEBRASKA NO. 41

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

43



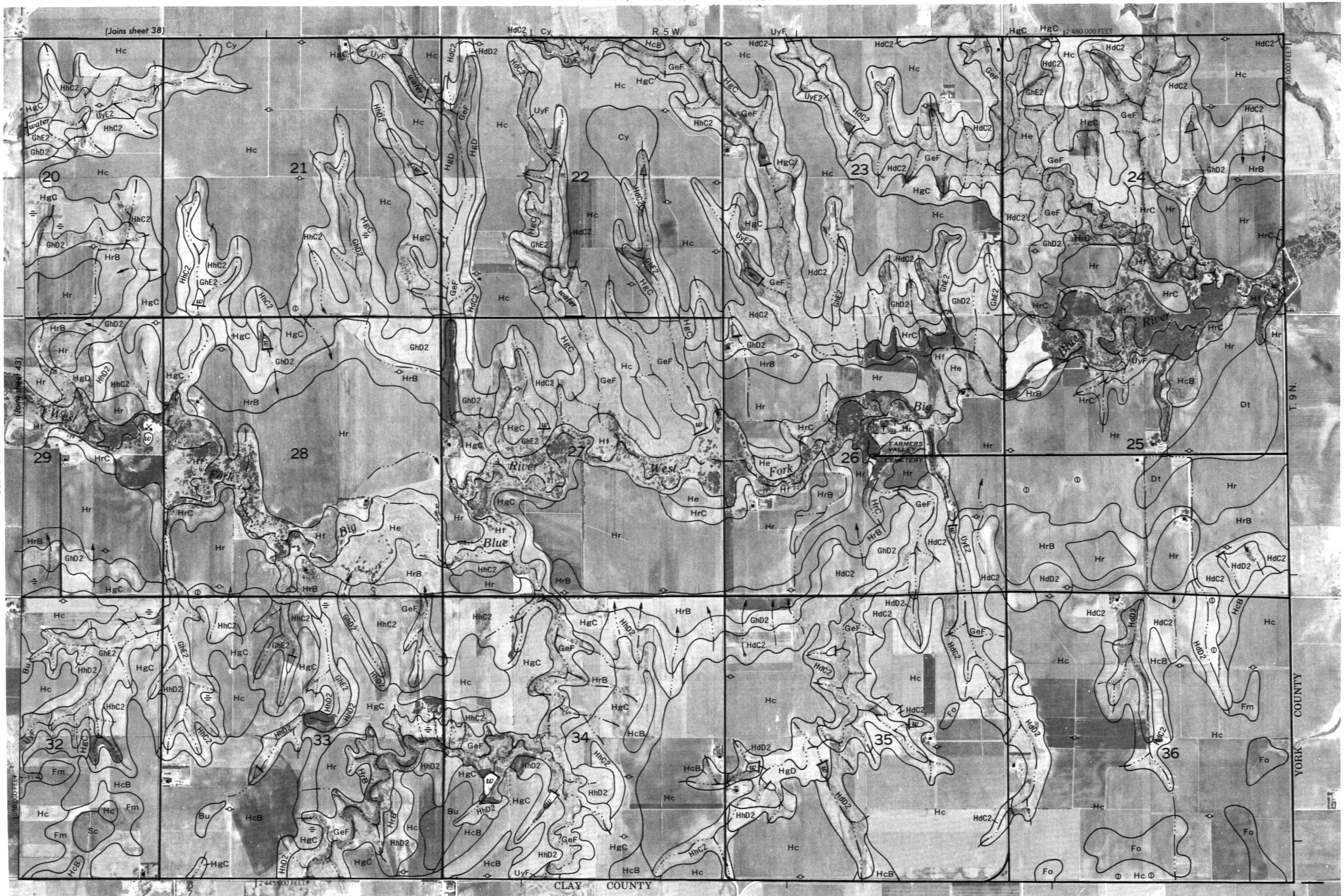
HAMILTON COUNTY, NEBRASKA NO. 43

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA — SHEET NUMBER 44

N

1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, NEBRASKA NO. 44